REPORT

ON THE

SAIDAPET EXPERIMENTAL FARM, &c.,

FOR THE

YEAR ENDING 31ST MARCH 1879.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT PRESS.
1879.

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THE BOTANICAL AND EXPERIMENTAL GROUNDS.

1. These grounds, which were briefly referred to in paragraph 31 of the last report of the School of Agriculture, occupy a piece of land measuring about 5·2 acres which was set apart for the purpose early in 1877.

They are divided into three plots, each plot being a terrace rising by gradation from the river bank. The site was selected on account of its proximity to the College site, and its easy access from the main road of the Farm, which constitutes its northern boundary; and also on account of the facility with which water for irrigation can be obtained from a water-lift close by, as well as from the channel forming its western boundary. The soil had nothing to recommend it, being in some parts indeed of the worst description met with on the Farm, consisting chiefly of coarse sand, but it was thought that the application of clay, a bed of which was met with whilst excavating the channel mentioned above, and a liberal supply of manure, combined with judicious treatment, would bring the soil into a sufficiently fertile condition in a short time; an expectation which had been completely realized whithin one year and a half.

Arrangement of the upper terrace.

2. On the upper terrace the ground was laid out in four slopes and two ridges for irrigation purposes according to the ridge and furrow system. The soil needed to fill the hollows and the lower portion was obtained in excavating the channel. After the ground had been levelled, the whole field received a dressing of black clay to the depth of three inches. The next heavy rain dissolved the clay and washed it into the soil, distributing it through the surface soil. The ground was then dug over to a depth of 1¼ feet, and the land was divided into four equal sized main plots by two roads, one running through the centre of the field from north to south at right angles to the main drive of the Farm, and the other road running from east to west. Each main division was then sub-divided by an irrigation channel, made of concrete, laid on the ridge, running from east to west, and each sub-division was again divided into six beds, each measuring 36 feet in length and 18 feet in breadth, leaving foot-paths 4 feet wide between each. Each bed is thus connected with the irrigation channel from which it receives its water by means of a drainage pipe inserted in the concrete channel. Around the whole field a margin nine feet wide was left, and at the inner side of the margin a path was made, thus making every portion of the garden easily accessible. The roads were made from 10-12 feet wide. The land was then allowed to lie untouched for several months, after which time it received a second dressing of clay and was again dug over about 1 foot deep, and on being heavily manured with horse-dung was fit for cropping at the commencement of the year 1878. This portion was laid out chiefly with the view to afford instruction to the students of the Agricultural College; to conduct experiments on a small scale with plants regarding the habits and requirements of which little or nothing is known; and finally to acclimatize and propagate plants raised from imported seeds.

3. In order to ensure success in acclimatizing plants they must receive more attention than can be bestowed upon crops when grown in the fields. A plant grown from seed newly imported often meets with conditions differing greatly from those under which it grew formerly, and to which it was accustomed; such plants must be carefully attended to; their growth must be carefully watched, and the minutest changes must be noted as indicating the wants of the nurslings and

showing in what direction the treatment must be altered to aid their growth or to effect a cure. It is of the utmost importance in conducting experiments in the acclimatization of plants, &c., to secure the conditions most favorable for their growth and to eliminate everything that may cause any disturbance. It may perhaps be remarked that plants that require so much attention are of little agricultural value. It must, however, be remembered that plants of a high type, like animated beings, when placed under conditions much dissimilar to those they have been accustomed to, will suffer more or less, and that their organic structure must undergo a change and must adapt itself to new circumstances, and until this is effected the plant must go through a crisis out of which it will pass triumphant, if the conditions affecting its growth have not been too strongly opponent to its wants. Great care must consequently be taken to eliminate any disturbing elements, or the plant may fall a victim to circumstances that are uncongenial to its growth, and to which it cannot accommodate itself. After a plant has once arrived at maturity under certain circumstances, there will be but little difficulty, with common care, in propagating the species; although most probably a new variety may be formed under the altered climatic influences.

Difficulties of acclimatization.

4. The arrangements made in this part of the garden are such that a great diversity of plants can be grown on a small scale for the demonstration to students of the value of different species and varieties. Although the chief aim is thus to raise such plants that are, or promise to become, valuable to the Agriculturist, the botanical side of the question has not been lost sight of. Arrangements have been made to raise a great variety of plants solely for the purpose of providing specimens for demonstration in the lectures on Botany: in this respect the garden is an appendage to the lecture-room.

5. The second terrace, which lies on a level a few feet below that already described, was laid out as follows. A margin 4 yards wide around the whole field was divided into small beds in which it is proposed to grow trees, grasses, vegetables, &c. The centre portion of the field is divided into two plots of equal size by a road running from north to south; this road is a continuation of the central road of the upper terrace. The plots measure about five-eighths of an acre each and are large enough to admit of field operations being performed by means of cattle power. The plots can be easily irrigated from the well close by, but the land having been levelled only about a year ago, and the soil not uniformly weathered as yet, does not admit of regular cropping, nor is it fitted for experiments. The land was laid out chiefly with a view to propagate such species of plants as may have been partly acclimatized; and to conduct experiments on a larger scale than in the first terrace and under conditions more nearly resembling those met with in ordinary field practice.

Arrangement of the second terrace.

6. The following are some of the crops that have been raised during the past year.

7. *Yellow Cholum* (Sorghum vulgare).—This crop having been very much attacked by smut during the year 1877, an experiment was instituted to ascertain the strength of a solution of sulphate of copper necessary for dressing the seed to prevent the attacks of that fungus. For this purpose 4 plots of the ground were set aside, each bed measuring 6 yards in width and 12 in length; each plot was made up into six ridges, each ridge measuring therefore 1 yard from centre to centre; the ridges were 2 feet wide and between them a furrow 1 foot wide was left. All the beds had been treated alike as regards depth of digging the soil and amount of manure used. In each bed, 1,000 cubic centimetres, or a little less than 2 lb. of seed were sown in 4 lines on each ridge, the lines being therefore 6 inches apart. For the first bed the seed was steeped in 750 c. c. of pure water ($\frac{3}{4}$ths of the volume of the seed used). For the second bed the same amount of seed was steeped in 750 c. c. of water in which 2 grammes of sulphate of copper had been

Experiment with dressings of sulphate of copper.

dissolved (the amount of sulphate of copper in the solution being in this case 0·266 per cent.) For the third bed 1,000 c. c. of seed were steeped in 750 c. c. of water in which 6 grammes of sulphate of copper had been dissolved (the amount of the sulphate of copper in the solution being here equal to 0·798 per cent.) The fourth and last bed was sown with 1,000 c. c. of seed steeped in 750 c. c. of lime water. The seed in every case was steeped for 15 hours and was sown on the 8th of May 1878 ; it germinated freely, and when the plants were about six inches high the crop was hoed. After hoeing no water was applied on the ridges, but the water was let into the furrows between them; to prevent the formation of any surface crust. No further hoeing was required, the plants growing rapidly and suppressing all weeds. The plants grew uniformly in all the beds until they were about 7 feet high, when the plants raised from seed steeped in lime water grew more rapidly than those in the other beds and attained a height varying from 12—14 feet; the crop in the remaining beds reached a height of only from 10—12 feet. The cholum was fit for cutting in the middle of August; but was not cut until about a month later on account of unfavorable weather. The cholum in all the beds was a little attacked by rust but no smut was met with. The outturn of green fodder was as follows :—

Amount used and method of steeping.

Bed.	Treatment of Seed.	Yield per Plot.	Yield per Acre.
		LB.	LB.
B 11 ...	Steeped in pure water	1,126	75,692
B 9 ...	Steeped in water containing ·266 per cent. of sulphate of copper...	980	65,878
B 7 ...	Steeped in water containing ·798 per cent. of sulphate of copper..	1,176	79,053
C 4 ...	Steeped in lime water	1,344	90,346

Although the result of the foregoing experiment did not contribute anything to answer the question for the sake of which it was instituted, the results obtained are very valuable in showing what can be effected by high cultivation. The soil on which the cholum grew was nearly sterile in 1876, and in 1878 a crop was obtained at the rate of 90,000 lb. per acre, which is more than twice the amount of cholum fodder received at one cutting from any field on the Farm previously. The greatest amount of fodder was yielded by the bed in which the seed sown had been dressed with lime water. This was probably due to the stimulating effect that lime exercises on vegetable life.

Test of the effect of sulphate of copper on the vitality of seed.

8. It being well known that when a very strong solution of sulphate of copper is used for dressing seed it decreases its vitality, an experiment was made to ascertain how far seed raised in this country is affected by the dressing. For this purpose American maize seed was used. The cobs, from which the grain was obtained, had been harvested before the end of March and were dried for a few days before the experiment commenced. On the 2nd of April at 9 A.M. 400 grammes (12·86 oz.) of seed were placed to steep in pure water; 400 grammes in water in which $2\frac{1}{2}$ grammes (38·58 grs.) of sulphate of copper ($Cu.S.O_4$) had been dissolved; 400 grammes in water in which 5 grammes (77·16 grs.) of sulphate of copper had been dissolved; and 400 grammes in water in which 10 grammes (154·32 grs.) of the same salt had been dissolved.

The seed was placed in chatties of the same size, and water was used in such an amount as to cover the seed with about one inch of water. This water was poured off on the 3rd April at 3 P.M., and the seed was then left in the chatties, and covered with moist blotting paper until the 6th of April at 3 P.M. when it was examined and the seeds that had sprouted counted. The following are the results :—

Sample.	Total Number of Grains.	Grains sprouted.	Grains not sprouted.	Sprouted, per Cent.	Remarks.
No. 1.—Steeped in pure water.	1,305	1,172	133	89	Most of the germs from ½ to 1½ inch long.
No. 2.—Steeped in water in which 2½ grammes of $Cu.S.O_4$ had been dissolved.	1,260	872	388	68	Most of the germs from ½ to ⅛th of an inch long.
No. 3.—Steeped in water in which 5 grammes of $Cu.S.O_4$ had been dissolved.	1,445	497	948	34	Germs only appearing and looking sickly.
No. 4.—Steeped in water in which 10 grammes of $Cu.S.O_4$ had been dissolved.	1,274	212	1,062	16	Germs only appearing and looking dead; some of the germs being apparently destroyed by the strong solution in the act of appearing.

The results of this experiment show clearly that by using a large amount of sulphate of copper the vitality of the seed will be destroyed. If the result obtained with the sample steeped in pure water represents the normal vitality of the seed, then, in sample No. 2, 21 per cent. of the vital seed was destroyed by the solution of copper. The dressing in this case was at the rate of 11·7 oz. of the salt per 100 lb. of grain. Although in the practice where the seed is put into the soil the loss would not amount to 21 per cent., especially when the soil is rich in lime, yet the amount of sulphate of copper used for the second sample was far too much for practical purposes.

9. If the seed had been steeped for a shorter time the vitality would have been probably greater. According to Kuhn, Dreish, and others who have made numerous experiments on this subject not more than 5 oz. of sulphate of copper should be used per 100 lb. of grain, and even then the loss of vitality of some of the grains cannot be entirely prevented. Most probably some of the germs that appeared to be dead will revive again when put into the soil, and some grains that appear to have no vitality may germinate under more favorable conditions, it being well known that seed that has been dressed with sulphate of copper germinates later than others that have not been dressed, and also that those which are heavily dressed germinate more slowly than those to which only a light dressing is supplied.

10. Steeping is considered better than sprinkling because when the seed is steeped the solution must penetrate into the grain and can then destroy such spores as are imbedded in the seed. The results obtained in this case tend to corroborate the assertion mentioned above, but it will be necessary to repeat the experiments to ascertain the amount of sulphate of copper that should be used for the dressing of various grains to secure the best effects. It should, however, be remembered that the loss of vitality on the part of the less vigorous seed may be an advantage within certain limits in keeping out sickly plants from the crop.

Effects of deep and shallow sowing.

11. Another set of experiments was instituted with yellow cholum to investigate the effect of deep and shallow sowing. For this purpose three beds were sown on the 19th of October. The soil of the beds was uniform and their preparation alike. In one bed the seed was placed 1 inch; in the second 3 inches; and in the third 5 inches deep. The seed in all the beds germinated very well and the plants grew with uniform vigor until about 2 feet high, when the plants growing from the seed sown 1 inch deep commenced to suffer from the effects of the powerful

sun prevailing at that time, and were soon afterwards so severely attacked by rust that it appeared as though every function of life were extinct. The plants raised from the seed deposited 3 inches deep were but little attacked by rust, and those raised from seed sown 5 inches deep were nearly free from the disease. Soon after the rust appeared, the beds on which the cholum was growing were watered every day to such an extent that the soil was thoroughly soaked. This was continued for about a week, when it was observed that the cholum, that was stunted, had revived again and was making a fresh start ; it afterwards attained nearly the same height as that in the other beds. The rust, which had covered nearly the whole plants at the middle of November, had almost entirely disappeared a month later.

The crop was cut on the 3rd of February 1879. The following table shows the weight of green fodder received from each bed :—

Bed.	Treatment of Seed.	Yield per Plot.	Yield per Acre.
		LB.	LB.
C 5 ...	Sown 1 inch deep	252	16,940
C 4 ...	Do. 3 do. do.	208	18,823
C 3 ...	Do. 5 do. do.	368	24,737

The results of this experiment are very instructive. They show clearly that the plants only suffer from this disease (rust) when they are weakened and the functions of life are paralyzed by adverse conditions, and that they can recover their vigor if the principal cause of the disturbance is either removed or its effects neutralized at the proper time.

12. Owing to the fact that the roots of the plants, sown shallow, would be more confined to the surface than those of the plants sown deep, and through the temperature of the surface soil being raised by the direct action of the sun, the roots of the former plants were exposed to inimical circumstances which probably were so powerful as to impair the exercise of the functions of preparing and conducting food to the other parts of the plants on their part, and thus caused the debility of the whole plant, and nullified its power of resisting the attacks of disease. The results of this experiment are different to those of others made on the Farm with crops grown under dry cultivation. In some of these experiments the seed sown at 5 inches in depth failed to germinate. This apparent contradiction may be attributed to the differing conditions of the soils experimented with, and illustrates the necessity for repeating such experiments under as great a variety of circumstances as possible before attempting to draw general deductions.

Sowing seed at various distances.

13. A third experiment with yellow cholum was instituted to determine the effects of sowing seed in lines at various distances apart ; and three beds were set aside for this experiment (the same as those in which the Sorghum to be referred to grew). In one bed two lines were sown on each ridge ; in the second bed three, and in the third four lines. The soil of all the beds was similar and the ridges were of equal size. The seed, which had been steeped in lime water, was sown in equal amounts in all the beds on 19th October ; it germinated well and the plants grew uniformly and vigorously.

The crop was cut on the 28th of January last with the following results :—

Bed.	Number of lines sown on each ridge.	Yield.	Yield per Acre.
		LB.	LB.
A 1 ...	2	448	30,116
A 2 ...	3	481	32,334
A 3 ...	4	504	33,981

It will be noted that the yield was heaviest where four lines had been sown on each ridge and where consequently the lines stood more closely. This is in accordance with general experience. Fodder raised in this manner is also usually more tender, and juicy, and therefore both better food for, and more palatable to live stock.

14. *Chinese Sugarcane* (Sorghum saccharatum).—This crop having as yet only been successfully grown on the Farm as a cold season crop, an endeavor was made to grow it in the hot weather. For this experiment three beds were used, which were all similarly prepared and the soil of which was alike. The seed was sown on the 27th July 1878; in the first bed ½ inch deep, in the second 2 inches deep, and in third 4 inches deep, it germinated well and the plants grew vigorously. The crop was watered occasionally and was cut on the 16th October. The yield was as follows:—

Bed.	Depth of sowing seed.	Yield.	Yield per Acre.
		LB.	LB.
A 1 ...	½ inch	520	34,956
A 2 ...	2 inches	622	41,812
A 3 ...	4 „	678	45,577

The results of this experiment show that under high cultivation and occasional watering the crop may be grown during the latter part of the hot season as well as during the cold weather. It must however be mentioned that the favorable result is undoubtedly greatly due to the peculiar weather, which was very favorable for growing crops, during August and September. The heaviest outturn was also here obtained from seed sown deeply.

15. *Black Cholum* (Sorghum?).—On the 11th June, two beds were sown with black cholum obtained from Trichinopoly. The seed germinated well, and the plants grew very rapidly and attained a height from 11 to 12 feet. The plants closely resembled the Chinese sugar-cane, but the stalks were rather thinner and the panicle spread less, that is, the heads were less open. The following are the results obtained:—

Bed.	Yield of Fodder.	Yield per Acre.
	LB.	LB.
C 3	744	50,013
C 5	688	46,248

The outturn certainly is very satisfactory; these figures show that black cholum grows very well, and better than the Chinese sugar-cane during the hot season, for the seed was sown in June, a month earlier than the crop above referred to, at which time the weather was very unfavorable for the growth of crops.

16. *Red Cholum* (Sorghum?).—On the 21st June, two beds were sown with this crop. The seed, which had been obtained from Salem, germinated very well and the plants grew vigorously at first; but when about 2 feet high they gradually withered up. It was evident that either the weather or the soil did not agree with them. The plants attained only a height of 6 to 7 feet and the crop was cut on the 21st of September, exactly three months after sowing; the outturn was at the rate of 33,000 lb. per acre.

17. *Maize* (Zea mays).—During the year 1877 seeds of ten varieties of Maize were received from Italy. They were sown in small beds in January 1878. The seed germinated freely but the plants did not succeed well. They evidently suffered from the powerful sun. The plants reached a height of about 6 feet and matured a few cobs, which however were small. Some seed of the best varieties thus obtained was sown on the 10th of December 1878. Although the plants raised

from this seed grew more vigorously than the mother plants and the cobs were much larger than the first time, yet neither did the plants nor the cobs attain the size of the American maize.

An interesting phenomenon was observed on one of these plants. The male part of the flower instead of being separated from the female was connected with it and remained in this position until the cob attained maturity : generally the male flower crowns the plant, the female being situated part way down the stem.

18. Some maize seed obtained from America, was sown on the 10th of December last. The seed germinated very well and the plants grew luxuriantly. Many of the plants produced two cobs, all of which were of great size; the following figures show the weight of some of them. One cob, weighing 14½ oz. contained 710 grains which weighed 8 oz. Another cob weighing 13 oz. and contained 611 grains which weighed 7½ oz. The yield was at the rate of 823 lb. of grain per acre, which is very satisfactory considering the nature of the season.

19. *Wheat.*—Two samples of common wheat, one red and the other white, were received from the North-West Provinces; samples were also obtained from Bellary and Kurnool, and of spelt wheat from Cuddapah and Salem. On the 3rd of October a bed was sown with each of these 6 samples. All the wheat germinated well, but the plants raised from Salem spelt wheat and Bellary wheat suffered from the commencement and the plants died within three weeks after they appeared above ground. The plants raised from the red wheat received from the North-West Provinces grew well at first, but commenced to wither within about five weeks after their appearance above ground. The plants of the remaining varieties grew very well at first but were checked in the latter part of November, reviving however again in December and growing very vigorously afterwards: they attained a height of about 2 to 2½ feet. The plants flowered in the middle of January and the crop was harvested in the middle of February. The outturn of grain was very small, most of the ears being empty. This is the first time that wheat has been cultivated here with any success, and had it not been for the exceptionally bad season the yield of grain would have been much better; a somewhat stiffer soil than that used would probably also, have increased the outturn.

20. *Grasses.*—The following are some notes made on the growth of some grasses raised from seed obtained from Queensland.

Andropogon halepensis.—Six feet high at present, flowered some weeks ago; stem succulent but attacked by rust. This is undoubtedly a heavy fodder producer.

Festuca Billardierrii.—Stem one foot high, rather wiry, has few leaves, may be a good cattle food when mixed with more tender species.

Chloris ventricosa.—1 foot high; more wiry than the foregoing, but possesses more leaves.

Panicum spectabile.—Very similar to the foregoing.

Andropogon annulatus.—4 feet high; growth not completed; not yet flowering.

Arundinella Nepalensis.—1½ feet high; flowering at present; possesses a considerable number of leaves, but is rather coarse; it may prove a useful fodder for mixture with other grasses.

Sporobolus elongatus.—A grass with a flattened stem and with roots ramifying greatly, well adapted to a hot climate in this respect; but rather coarse.

21. *Guinea Grass* (Panicum jumentorium).—Some seed having been collected on the Farm last year a few small beds were sown with it. The seed germinated very well. The plants grew remarkably vigorously and the leaves attained an extraordinary breadth and reached a height of about five feet. The tendency to produce leaf seems to be greater with plants raised from seed, than from those grown from roots in the usual way.

22. *Sea Island Cotton* (Gossypium Barbadense).—A supply of seed of this variety of cotton having been obtained from America last year, one bed was sown with it on

the 10th of May. Great difficulty was experienced in raising the plants, for the seed had a very low percentage of vital grains, and, although it was sown very thickly, the plants appeared unevenly over the ground, which necessitated several resowings to fill the blanks. To prevent the surface from being crusted over, which is so detrimental to germination and to the first growth of plants, the seed was first covered with about one inch of soil and then with about two inches of horse manure. The beds were also frequently watered to keep the temperature of the soil low, but in spite of these precautions the plants made little progress at first. The showery weather of August and September revived the plants, which after that time grew very vigorously. The plants flowered profusely during October and November, but all the flowers dropped off. The rank growth during August and September probably caused this. The cotton again commenced to flower heavily in December; this time very few of the flowers dropped off. Some cotton was gathered from January up to March; that gathered in January was the best, the boles being large and the lint very long. Most of the boles produced during February and March were attacked by an insect, which was generally found inside the seeds and thus prevented the seed from maturing and lessened the amount of lint produced. Some of the seed received from this bed has been already sown in another plot, where it germinated freely.

23. Some *Upland Cotton* seed (Gossypium hirsutum), also obtained from America, was sown at the same time as the Sea Island Cotton. The seed germinated much better than that of the latter variety, and the plants grew slowly but steadily; they also did not produce so much wood and leaf. Flowering commenced later and the flowers were fewer in number than in the case of the Sea Island Cotton, but few of the flowers dropped off, and the yield was much better. The cotton was all gathered in the middle of March, when apparently all circulation of sap had ceased. The plants then were cut down one foot above the ground and the plot was watered and dug over. At the end of the month the old stools were throwing out fresh shoots. The lint of this cotton is very short, but the variety is very much esteemed in America on account of the heavy outturn it gives; it is said that while Upland Cotton yields 400 to 500 lb. of lint per acre, the Sea Island Cotton yields only 200 to 250 lb.; so that, although the price of the latter cotton is much higher than that of the former variety, an acre of Upland Cotton yields more profit than one of Sea Island.

24. *Yca Valley Cotton.*—A few seeds of this valuable variety were sown in January 1878, and two plants were raised from it. The plants grew slowly but steadily until they had attained a height of about 7 feet in December 1878. The plants flowered in September and October last but all the flowers dropped off. Some seed however was gathered during February and March, which will be sufficient for propagation. The seed is very large and when fresh its surface is very oily. This accounts for the lint being often stained.

25. The following are some results obtained in weighing the seeds of the three varieties of cotton already referred to :—

Variety.	Seeds in 1 lb.
Yca Valley	7,000
Sea Island	9,000
Upland	14,000

25. *Bamieh Cotton.*—Some seed of this cotton was received from the Government of India early in the year, and was sown on the 5th of April. The seed germinated well and the plants grew vigorously until most of them had attained a height of about 7 feet in September, when they commenced to flower; but as nearly all the flowers dropped off, only a few seeds were gathered. The plants stood very closely on the ground and developed very few side branches; but some of the seed

raised here when sown produced shorter and more branched plants, these showed the latter tendency so strongly that they differed little from the New Orleans cotton. The plants being much attacked by insects were cut down to one foot above the ground and had commenced to shoot from the old branches before the end of March. From the result of this experiment it would appear that the character of this cotton is the result of a particular cultivation and is not fixed enough to mark it as a separate species.

26. *Brazil Cotton* (Gossypium religiosum).—Some seed of this species of cotton was sown on the 22nd May 1878; it germinated well and the plants grew vigorously until they were about 6 feet high in November last. The plants then commenced to flower, but most of the flowers dropped off and only a few seeds had been gathered at the end of March. The peculiarity of this cotton is that the seeds are closely attached to one another. The state of growth is very bushy and the plant might well be used as an ornamental shrub in gardens. Some of the plants were cut down to one foot above ground during the month of February to ascertain whether this may not induce them to produce better.

27. *Nankin Cotton* (Gossypium Siamese rubra).—Some seed of this variety of cotton was received from Italy, with the maize already referred to, and sown in the month of January. The seed germinated but the plants have not thriven well; they are very small and have produced but little up to date. Some of the seed gathered will be again sown, and it is possible that the plants raised from this seed will thrive better than the plants grown from the imported seed. As far as may be judged at present this cotton does not possess any great agricultural value.

28. *Hemp* (Cannabis sativa).—Some beds of hemp are now growing on the grounds. Although the plants appear healthy yet they require evidently a moister atmosphere and a lower temperature of soil than that met with here at this time of year. Some of the plants even commenced to flower before the end of March, when only about 4 feet high, which completely destroys the hope of obtaining a fair yield.

29. *Malachra rotundifolia.*—Some seed of this fibre plant was received from Student N. H. Patuck, who obtained it from Bombay where, it is said, the plant grows wild. The seed was sown at the commencement of February 1879, at first the plants grew very slowly and appeared stunted, but on supplying them with enough water to keep the soil always moist they revived and grew very rapidly and had attained a height of 3 feet at the commencement of April 1879.

30. *Jute* (Corchorus capsularis).—On the 4th of February three beds were sown with this crop. The seed was sown very thickly, four lines in each ridge. The seed germinated very well but the plants grew very slowly until about the 20th of March, when they were about 9 inches high, about 2 inches of rain fell on that and the two following days, and the weather continued to be cloudy for several days longer. During this time the plants grew so rapidly that at the end of March most of them were $4\frac{1}{2}$ feet high. As the plants stand very closely they are all remarkably straight and have few side branches.

31. *Indigo* (Indigofera tinctoria).—Some beds were sown with indigo chiefly with the view to ascertain what yield can be obtained under high cultivation. The seed was sown on the 25th November 1878. The seed germinated well and the plants grew vigorously and had attained a height of 4 feet, when the crop was cut on the 5th March 1879. This cutting yielded at the rate of 120 bundles per acre; each bundle weighing 92 lb. The yield is certainly very heavy for a first cutting. Commonly sixty bundles of the same girth, each weighing 60 lb., is considered a fair yield. The crop was however occasionally watered.

32. *Tapioca* (Jatropha manihot).—On the 21st of August a bed was planted with cuttings of this crop. The cuttings were placed half yard distant in the lines and the lines were 1 yard apart. The cuttings struck root easily and attained a height of 6-7 feet. The plants were cut down and the tubers taken up on the 4th March 1879. The yield of tubers was at the rate of 10,880 lb. per acre. This outturn

is certainly very satisfactory. The plants are most easily propagated and require little attention during their growth. As the branches and leaves soon cover the ground little irrigation is necessary.

33. *Arrowroot* (Curcuma augustifolia).—A bed was planted with this crop on the 19th August 1878; it grew fairly, but required more water than the tapioca; the tubers were taken up on the 1st of March; the yield was found to be at the rate of 3,764 lb. per acre.

34. *Castor.*—Seeds of the following nine varieties of this plant were received from Italy at the close of the year 1877:—

Ricinus communis.	Ricinus communis cyclonthe.
,, ,, herbaceum.	,, microstatum.
,, ,, cuban.	,, miscrospermum.
,, ,, utilosus.	,, purpureum.
,, ,, spectalite.	

They were sown on the 16th January 1878. Nearly all the seeds germinated and the plants appeared above ground on the 24th January. The plants all grew very vigorously and some of them attained a height of 10 feet in a short time. Only a few seeds having been received, the seed of all varieties was sown in one division of the garden; the different varieties consequently grew in proximity to each other. Of each variety 2—6 plants were raised, except of *Ricinus mycrospermum,* which is the medicinal castor-oil plant, of which 14 plants were raised. The plants flowered and produced seed nearly throughout the year. Some of the trees yielded very well. Of the species *Ricinus purpureum* two plants were raised; both trees grew to a great height; these trees are very ornamental, being profusely covered with leaves and flowering and bearing continually, and would make a very good shrub for gardens. These two trees are in appearance alike, but the seed differs very much; the beans of the one tree being much larger than that of the other. The produce of one of the trees amounted to 15 lb. of beans during the year.

It would appear that all the plants hybridized except the *Ricinus mycrospermum* as none of the seeds of two trees are exactly alike. The *Ricinus mycrospermum* it would appear did not hybridize on account of the characters of the plant being more distinct from the other varieties than those of the remaining varieties between themselves. Not only the seed of *Ricinus mycrospermum* but also the plant varies very much from the other varieties; the color of the plant is light green and the leaves themselves possess this color; the whole tree has the appearance of an umbelliferous plant growing in a globular form, which habit gives the plant a nice appearance.

35. As all the varieties grew very well, it may be assumed that, after being fully acclimatised, some of them will be found to be well adapted to the conditions met with in this country and at the same time to produce better results than those cultivated at present.

36. *Pithecolobium saman,* the so-called Rain-tree. Some plants of this variety were received from the Horticultural Gardens at Madras at the end of September 1878. Some of them were planted in the Botanical Garden. All the trees grew very well and one of them had attained 10 feet in height at the end of March 1879; this tree grew 7 feet in six months, which proves that this tree is very well adapted to the conditions met with here.

37. We are under obligations to Professor Italo Giglioli, M.R.A.C., of the Royal High School of Agriculture, Portici, Naples, for a valuable collection of seeds from Italy and Sicily, which unfortunately could only be partially utilized; but the maize already referred to, the castor beans, and the Nankin cotton, besides some tobacco seed of the species *Nicotiana macrophylla* were successfully grown; the latter particularly so. To the Acclimatization Society of Queensland we are indebted for several packets of grass seeds, and seeds of a variety of *Eucalypti;* as also are we to W. Hill, Esq., Director of the Botanic Gardens, Brisbane, for similar contributions. According to the present arrangements it is, however, almost impossible to obtain

all the advantages, which such a garden could confer, from these grounds, as the Officer in charge of the Farm is unable to devote so much time to it as is required to ensure perfect success in every direction. Last year, at a time when the garden was not entirely under cultivation, from 300 to 400 varieties of seeds and plants were put down at one time. Their growth could not be satisfactorily watched and attended to in the course of a flying visit to the garden every day, and the result was that many failures had to be recorded, which if more time could have been devoted to the work might have been avoided. The botanical grounds attached to Agricultural Colleges in other countries are generally under the management of the Professor of Botany or Professor of plant culture, which system, if imitated here would open a wide and useful field of investigation in subjects which have been but little studied in this country.

(Signed) K. SCHIFFMAYER,
Asst. Supt. of Govt. Farms in charge.

SAIDAPET,
3rd May 1879.

THE ANNUAL PLOUGHING COMPETITION.

1. This competition, after being in abeyance for several years, has been revived, and it is hoped will become a permanent institution. The interest taken in it by all classes, as shown by the numerous gathering on the present occasion, demonstrates its value, for it thus becomes a means of attracting attention and showing the value of improved implements of tillage over those of time-honored use. The matches commenced at 6 A.M. this morning, when the following prizes were competed for :—

Class.	Qualifications.	Prize.	Description of Prizes.	Value.
				RS.
I.	Open to all.	1	A Swedish plough	25
		2	An American plough	20
		3	Implements or seeds	15
		4	Do. do.	10
		5	Do. do.	5
II.	Students of the School of Agriculture only.	1	A Swedish plough	25
		2	An American plough	20
		3	Implements or seeds or Agricultural Books.	12½
		4	Do. do. do. ...	7½
III.	Ryots or their laborers only.	1	An American plough	20
		2	Money	10
		3	Do.	5

2. The following gentlemen kindly consented to act as judges :—

Class I	J. H. Garstin, Esq., C.S.I. J. F. Price, Esq. L. R. Burrows, Esq.
Class II	H. E. Sullivan, Esq. Surgeon-Major W. R. Cornish, M.D. Major B. Hobart, R.A.
Class III	L. A. Campbell, Esq. F. G. Shaw, Esq.

3. In awarding the prizes the following merits were considered, points being allowed to each as mentioned below :—

	Points.
Depth	25
Straightness	25
General finish	25
Speed	5[illegible]
Total .	

4. The general public were not admitted into the fields during the co
as the cattle would have been frightened by the presence of such an unusu
and have become altogether unmanageable; the land on which the matches
conducted was however so situated as regards roads that the whole of the work c
be easily seen by visitors, who were also perfectly free to enter the fields after
competitions were over.

5. In Class I, there were sixteen competitors; of these, nine were laborers on the Saidapet Farm, who worked with farm cattle and ploughs of European pattern, but who, however, had their cattle assigned to them by lot; six were ryots of the neighborhood who worked with the plough of the country; and one a student of the School of Agriculture, who, however, was obliged to retire, as his cattle had never been properly trained. In the field where this class worked, the soil is a sandy loam, and a crop of tennai had been recently harvested: the soil was fairly moist and in good condition for ploughing with European ploughs; although rather too hard for a native one. The prize-winners, who all worked with ploughs of European pattern are mentioned below; the marks awarded are noted and the time occupied in ploughing the plots, each of which was 490 square yards in area:—

Prize.	Name.	Points awarded.	Time occupied.	Rate of ploughing in a day of 8 hours.
			MINS.	ACRES.
1st ...	Mooroogan	98	34	1·49
2nd ...	Ellengolly	82	39	1·25
3rd ...	Annamalay	81	42	} 1·16
4th ...	Moonoosawmy	75	42	
5th ...	Muttu	74	48	1·01

The work done by the 1st Prize winner was extremely good, and the rate at which it was performed most creditable. The speed at which the cattle travelled was of course greater than that obtained in ordinary field work, but overdriving was in no way permitted. How much depends on the proper training of the cattle was most clearly shown on this occasion, for the winner of the 5th Prize, who took the first previous in competition in 1873, and who has certainly not fallen off in his capabilities, having been allotted a pair of cattle which were rather wild, and which had not been thoroughly trained, was unable to do as good work as had been expected of him. It must not, however, be supposed that a great deal of special training is required, for provided cattle are well broken to the yoke, and are docile, it is quite possible to fasten them to a plough without any extra training; this has often been done on the Farm without the slightest inconvenience. When yoked to a plough of European pattern, as in other situations, the manner in which cattle will work greatly depends on their temper; if they be docile, they will work well; if the reverse, considerable difficulties will always be experienced. The Native ploughs, competing in this class, completed their plots in 56, 33, 32, 49,56, and 36 minutes respectively, but in the amount of work done, that is, soil moved, none of them had in any way come near the competitors using European ploughs; in most cases the soil was only stirred in patches, the greater part being unmoved.

6. In Class II, thirteen students of the School of Agriculture competed; of these—

3 were Brahmins.
5 ,, Sudras.
4 ,, Parsees.
1 was a Native Christian.

The following were the results:—

Prize.	Name.	Points awarded.	Time occupied.
			MINS.
1st ...	Student N. M. Rego	95	48
2nd ...	,, R. Damodara Naidu	83	95
3rd ...	,, A. Mooroogessa Pillai ...	80	74
4th ...	,, N. H. Patuck	75	57

The field in which this competition took place is a fallow, the soil being for the most part a sandy loam; it was not in a very favorable condition for ploughing, being in places very hard. The work done was very creditable, and the judges expressed themselves highly gratified with the way in which the students took to the work without scruple. The students labored under considerable difficulties in the management of their cattle, although the 1st Prize winner showed great skill in this respect. The success they attained is the more creditable, when it is remembered that cattle will never obey strangers as they will their ordinary drivers, and that the students do not work in the same costume as ordinary coolies; their dresses causing a considerable degree of alarm to the cattle they drive.

7. In the Third Class, which was open to ryots and their laborers only, there were ten competitors, all of whom used the ordinary country plough. The plots allotted to them measured 600 square yards, but unfortunately the soil was in a far too dry a state to admit of Native ploughs working at all favorably. The following were the results:—

Prize.	Name.	Points awarded.	Time occupied.	Rate of ploughing in a day of 8 hours.
			MINS.	ACRES.
1st ...	Chellen Naick	76	73	·82
2nd ...	Sathasiva Reddy ...	75	50	1·19
3rd ...	Mooroogappa Naidu ...	74	30	1·98

The work done was very poor; in most of the plots but little of the soil was moved, none of course being turned over.

8. In Class I, the prize winners, working with European pattern ploughs, cut furrows about $7\frac{1}{2}$–9 inches deep, and 9-10 inches wide, thus turning over in every hundred yards of furrow run as much as 150 cubic feet of soil. A Native plough when working under the most advantageous conditions only cuts a triangular furrow about 6 inches wide at the top and 1 inch at the bottom, with a depth of about 5 inches, so that, in travelling 100 yards, it only moves 36·5 cubic feet of soil, or less than one-fourth of that turned over by the European ploughs in this competition. In the competition itself, although at times the depth mentioned above (5 inches) was attained by Native ploughs, they did not maintain that depth throughout their furrows, often missing pieces and probably not doing more than one-sixth of the useful work done by the prize winners in Class I; whilst of the value of the work done with the respective implements, no one who saw the results could have a shadow of doubt. The Native ploughs were nowhere.

(Signed) CHARLES BENSON, M.R.A.C.,
Asst. Supt. of Govt. Farms,
conducting the competition.

SAIDAPET,
12th December 1878.

THE SAIDAPET EXPERIMENTAL FARM.

SECTION I.

GENERAL.

Rainfall.—It has become a custom when estimating the capabilities of a place for agricultural purposes to be guided chiefly by the amount of rain that falls there during the year. Although a great amount of rain in a hot country generally betokens a good year, yet undue importance is often attached to it by persons who, looking only to the total amount of rain, make no allowance for the circumstances that modify the effects of the separate falls. The most important conditions, which affect the value of the rainfall, are the season at which the rain falls and the amount of rain that falls in a given time. The effects of a stated amount of rain must vary considerably according to the season at which it falls and the duration of time over which the fall is distributed, as also whether it falls in the evening or morning. When a fall of one inch of rain is equally distributed over six hours in the cold season its effects must be much more beneficial than when a fall of the same amount occurs during six hours in the hot season. In the first case the water will pass easily into the soil, which is more or less friable at this time, and after passing into the soil the water will not be so easily evaporated, because the temperature is lower, the soil loose, and the surface more or less covered with a crop; whereas in the latter case the water will only partly penetrate into the soil on account of its density, and will also be evaporated within a short time after the rain.

2. As regards a given amount of rain falling in a varying time, it is evident that if a fall of one inch of rain is distributed over 1 hour and another inch at another place on the same day over 24 hours, the effects of the rain must generally vary, in the first instance $\frac{1}{2}$ to $\frac{9}{10}$ths of the water that reached the surface of the soil would, according to its nature, flow off the ground, whereas in the latter case the whole may, under favorable circumstances, pass into the soil. To this it must be added that the first mentioned 1 inch of rain will beat down the soil and render it otherwise unfavorable to the growth of plants. In both cases 1 inch of rain would be registered in one day.

3. It is generally assumed that light showers of rain are more beneficial than heavy ones; this however can only be true to a certain extent. A light shower of rain is very beneficial to growing crops especially when the same cover the ground, to prevent rapid evaporation, but will fail altogether to have any effect on unploughed soil during the hot season. If during this time a shower of rain amounting to 0·1 or 0·15 falls in the early morning and is succeeded by a bright hot day, by the evening of the same day every trace of moisture will most probably be obliterated; and such an amount may even fall every morning during 10–12 consecutive days with no better results; whereas if the amount of rain that was distributed over ten or twelve days were precipitated during one day only, the effect would be much more favorable; the moisture in the soil would then suffice to admit of field operations being carried out and the soil would thereby be qualified to benefit more from subsequent small showers of rain.

4. *Season.*—The year under report was not favorable for the Farm, the total rainfall registered on the Farm was only 33·16 inches, the average of the previous ten

years being 51·12 inches. The bad effects resulting from this deficiency of rainfall were much intensified by its unfavorable distribution. Nearly half of the total amount of the rain (15·61 inches) fell at a time when it could have but little good effect on the crops, except to provide food for live-stock. The rain coming too late to admit the sowing of hot weather crops and too early to put down cold weather crops. From the register it will be seen that the rain in April was 0·67 inch, which is rather more than the usual fall during that month. Rain fell in May on five days; the total amount being 3·9 inches; it fell in slight showers except one fall of 1·65 inch, of which 1·5 inch was precipitated in less than one hour and consequently much of the water drained off the land. The rain that fell during this month enabled field operations to be begun but was insufficient for sowing the hot weather crops. During June only 0·1 inch of rain was registered; the average of the previous ten years being 3·40 inches: had there been some showers of rain during the early part of this month, gingelly, cumboo and other hot weather crops could have been put down, as it was, the traces of the rain that fell in May were entirely obliterated by the end of the first week in June, and the soil became so dry that all cultivation was stopped. In the month of July 3·32 inches of rain fell, which, although less than usual, was very effective, because well distributed; there were seven rainy days; the heaviest fall being 1·05 inch, which occurred on the 1st of the month and was followed by 0·45 inch on the 3rd and 0·55 inch on the 5th. These 2 inches of rain moistened the ground to such an extent that field operations could be resumed: it being too late for sowing regular hot weather crops, a considerable area of land was put under horse-gram and 60 days cumboo. Of all the crops put down, those sown during the month of July had the best chance of success. The rainfall in August amounted to 6·12 inches, the average of the previous ten years being 4·61 inches, the comparatively large amount of rain which fell during the month was very advantageous; the rain was distributed over ten rainy days and fell in gentle sho wers except on one day. The rainfall in September amounted to 6·02 inches and was distributed over fourteen rainy days. The weather was favorable during this month although rather a little too wet for sowing during the first half.

5. In October the rainfall amounted only to 7·02 inches, which was distributed over nine rainy days, nearly all of which were during the first half of the month. The weather continued favorable until the 18th of the month from which date the dry weather season may be said to have commenced; the bright days and powerful sun which prevailed predominating from this date gave the latter end of this month more the character of a hot season month than of a cold one; the evaporation from the soil was intense and the crops suffered from drought at the end of the month. At the commencement of November, a good shower of rain greatly revived the crops and gave them a fresh start; its effect however did not last long and the few showers that fell during the latter part of the month were too light to be of much use for the wants of the crops; some of which became so much stunted as not to revive afterwards. The total amount of rain that fell in November was only 1·19 inch, the average of the previous ten years being 13·16 inches. The deficiency of the rainfall in this month was disastrous in its effects on the Farm; not only were the cold weather crops so much stunted and weakened as to become a prey to the attacks of fungoid diseases and insects, but other crops, which are usually put down during or after the heavy rains, could not be sown at all. Paddy sown on the irrigable land in the northern part of the Farm, which depends for water on the Mylapore Tank, failed on account of the tank being entirely dry and remaining so the whole year; the wells resorted to afterwards ran dry.

6. The rainfall in December was 2·05 inches, which is but little more than half the average fall of the previous ten years. The fall of 1·55 inch on the 1st of December would have had a good effect on the crops if they had not been stunted by the exceedingly dry weather of November. During January 0·72 inch of rain fell, which was distributed over four days; this rain was sufficient to cause the germination of pulses sown at the time, but did little else, as most of the crops succumbed soon afterwards. It had however some good effect on the Guinea-grass,

which was enabled thereby to grow steadily and thus to provide some grazing for the sheep. No rain fell in February. During March 2·05 inches of rain were registered. This rain, being distributed over three consecutive days, did a great amount of good; it not only revived the Guinea-grass, which had stopped growing, but also benefited greatly the cotton and indigo crops. This rain was especially beneficial in its effect because it was followed by cloudy weather for several days, which prevented the rapid evaporation of the moisture from the soil. The soil was moistened to such an extent as to admit of tillage being commenced at a much earlier date than is usually possible, and thus our soils will have the benefit of a more thorough tillage than usual during the coming season.

7. The following table shows the monthly rainfall of the year compared with the average of the previous ten years' rainfall :—

Months.	1878-79.		Average of ten years.	
	Rainfall.	Wet days.	Rainfall.	Wet days.
April	0·67	2	0·33	·5
May	3·90	5	3·75	1·5
June	0·10	1	3·40	6·1
July	3·32	8	4·33	8·8
August	6·12	10	4·61	9·1
September	6·02	14	5·83	8·3
October	7·02	9	10·55	10·9
November	1·19	5	13·16	12·3
December	2·05	7	3·52	4·6
January	0·72	4	0·60	·9
February	...	...	0·89	·6
March	2·05	3	0·15	·5
Total ...	33·16	68	51·12	64·1

8. In the next statement the weekly rainfall is shown with the average weekly rainfall of the previous ten years :—

Weeks.	1878-79.		Average of the previous ten years.		Weeks.	1878-79.		Average of the previous ten years.	
	Rainfall	Wet days.	Rainfall	Wet days.		Rainfall	Wet days.	Rainfall	Wet days.
1st Week ...	...	...	·22	·2	27th Week ...	4·62	4	1·50	2·0
2nd do. ...	...	...	·01	·1	28th do. ...	1·62	1	1·71	1·7
3rd do. ...	·67	2	...	...	29th do. ...	·78	4	3·27	3·2
4th do. ...	..	...	·01	·1	30th do. ...	...	...	2·84	3·0
5th do. ...	·10	1	1·41	·5	31st do. ...	·97	1	2·15	2·3
6th do. ...	...	...	·11	·3	32nd do. ...	...	...	2·91	2·8
7th do. ...	2·10	2	2·25	·5	33rd do. ...	...	...	3·14	3·3
8th do. ...	1·70	2	·03	·2	34th do. ...	·12	3	3·22	2·7
9th do. ...	...	...	·08	·3	35th do. ...	1·65	2	3·78	2·8
10th do. ...	...	...	1·16	1·2	36th do. ...	·80	2	1·21	1·2
11th do. ...	...	...	1·38	1·9	37th do. ...	·09	2	1·13	1·7
12th do. ...	...	...	·27	1·2	38th do. ...	·33	2	·29	·5
13th do. ...	·10	1	·50	1·6	39th do. ...	...	...	·07	·8
14th do. ...	2·05	3	0·34	1·0	40th do. ...	·05	1	·00	·1
15th do. ...	...	...	1·24	2·2	41st do. ...	·35	1	·00	·1
16th do. ...	·80	2	·87	2·2	42nd do. ...	...	...	·59	·6
17th do. ...	·47	2	1·26	2·7	43rd do. ...	·32	2	·01	·1
18th do. ...	1·14	3	1·34	2·1	44th do. ...	...	...	...	...
19th do. ...	·63	2	1·29	2·5	45th do. ...	...	...	·69	·5
20th do. ...	3·88	3	·94	2·2	46th do. ...	...	...	...	...
21st do. ...	·47	2	·87	1·5	47th do. ...	...	...	·12	·1
22nd do. ...	1·17	1	1·24	2·0	48th do. ...	...	...	·14	·2
23rd do. ...	3·06	4	1·28	2·4	49th do. ...	...	...	·08	·4
24th do. ...	1·04	5	1·10	1·6	50th do. ...	...	...	...	...
25th do. ...	·15	1	1·59	1·7	51st do. ...	2·05	3	...	...
26th do. ...	·60	3	1·27	1·7	52nd do. ...	...	...	...	...

9. The following table shows the daily rainfall during the year :—

Date.	April 1878.	May 1878	June 1878.	July 1878.	August 1878.	September 1878.	October 1878.	November 1878.	December 1878.	January 1879.	February 1879.	March 1879.
1 ...	...	...	...	1·05	·37	1·17	·72	...	1·55	...	...	...
2 ...	...	...	...	...	·26	·37	·15	·97	...	...	...	...
3 ...	...	·10	...	·45	·51	...	...	...	·03	·05	...	...
4 ...	...	...	...	...	...	...	·70	...	·05	...	...	...
5 ...	...	...	...	·55	...	·01	...	...	...	...	...	...
6 ...	...	...	...	...	...	2·21	3·05	...	...	..	...	...
7 ...	...	...	...	...	...	·47	1·62	...	...	...	...	...
8 ...	...	...	...	...	·53	...	...	...	...	...	...	...
9 ...	...	...	...	...	...	·15	...	...	...	...	...	...
10 ...	...	...	...	...	...	·20	...	...	·02	...	...	...
11 ...	...	...	...	...	·10	...	...	...	...	...	...	
12 ...	...	...	...	...	·29	·25	...	...	...	·35	...	...
13 ...	...	...	...	...	·57	·05	...	...	...	...	...	...
14 ...	...	·45	...	...	3·02	·39	·14	...	...	...	...	...
15 ...	·20	1·65	...	...	...	...	...	...	·07	...	...	...
16 ...	...	...	...	...	...	...	·17	...	...	...	...	...
17 ...	·47	...	...	...	...	·15	·45	...	...	...	...	...
18 ...	...	...	...	...	...	...	·02	...	...	...	...	...
19 ...	...	...	...	} ·75	{ ...	...	...	...	·05	...	...	...
20 ...	...	·70	...	}	{ ·02	...	...	·01	·28	...	...	0·30
21 ...	...	...	...	·05	...	...	...	...	...	...	..	1·25
22 ...	...	...	...	·15	·45	...	...	...	...	·27	...	0·50
23 ...	...	...	...	·32	...	...	...	·01	...	·05	...	...
24 ...	...	...	...	...	...	·08	...	·10	...	...	...	...
25 ...	...	...	...	...	...	...	...	·10	...	...	...	...
26 ...	...	1·00	...	...	...	·25	...	...	...	...	...	...
27 ...	...	...	...	...	...	...	...	...	...	...	...	...
28 ...	...	...	·10	...	...	·27	...	...	...	...	...	...
29 ...	...	...	...	...	...	...	...	...	...	...	...	...
30 ...	...	...	...	...	...	...	...	...	...	...	...	...
31 ...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	·67	3·90	·10	3·32	6·12	6·02	7·02	1·19	2·05	·72	Nil.	2·05

10. The following table shows the daily rainfall from 15th of October 1878 up to 31st of December 1878 compared with the average rainfall of the previous five years for the same period :—

Date.	October.		November.		December.	
	1878-79.	Average of previous 5 years.	1878-79.	Average of previous 5 years.	1878-79.	Average of previous 5 years.
1 ...	...	...	...	...	1·55	1·44
2 ...	...	...	0·97	0·52	...	0·70
3 ...	...	...	...	0·02	0·03	0·37
4 ...	...	...	...	...	0·05	0·06
5 ...	...	...	...	...	...	...
6 ...	...	...	...	0·09	...	0·33
7 ...	...	...	...	..	...	0·06
8 ...	...	...	...	0·24	...	0·03
9 ...	...	...	...	0·65	...	0·11
10 ...	...	...	...	1·08	0·02	...
11 ...	...	...	...	0·27	...	0·17
12 ...	...	...	...	0·12	...	0·51
13 ...	...	...	...	0·24	...	...
14 ...	...	...	...	1·17	...	0·35
15 ...	...	1·2	...	0·97	0·07	0·08
16 ...	0·17	·68	...	0·35	...	0·05
17 ...	0·45	·10	...	0·30	...	...
18 ...	0·02	·05	...	0·22	...	0·10
19 ...	...	·06	...	0·17	0·05	...
20 ...	...	·30	·01	...	0·28	...
21 ...	...	·29	...	0·54	...	...
22 ...	...	·14	...	0·32	...	...
23 ...	...	·83	·01	0·66	...	...
24 ...	...	1·53	·10	...	...	0·02
25 ...	...	·71	·10	0·15	...	...
26 ...	...	·28	...	0·34	...	...
27 ...	...	·20	...	0·73	...	...
28 ...	...	·10	...	0·12	...	0·02
29 ...	...	·21	...	0·35	...	...
30 ...	...	1·51	...	0·88	...	...
31 ..	...	·07	...	...	...	...
Total ...	0·64	7·18	1·19	10·44	2·05	4·40

11. *Fungoid Diseases.*—The peculiarities of the season were very favorable to the development of rust. The drought that commenced at the latter end of October checked the growth of plants and predisposed them to the attacks of the disease. The parasite attacked all the yellow cholum, white cholum, and Planter's friend crops. It appeared first in a crop of yellow cholum raised from seed obtained from Bellary. Most probably in Bellary the seed was raised under conditions differing considerably from those it met with on the Farm; so that the crop grown here had not only to contend against an adverse season, but had also to adapt itself to the soil, &c.; circumstances which reduced the power of the plants for resisting the inroads of the parasite and predisposed them to disease. The germs of the fungus may have been in the soil, brought there probably with the manure; it being well known that when straw that has been attacked by rust is used as cattle food or bedding, the parasites may be propagated by using the manure for cereal crops, if the conditions affecting its growth are favorable.

12. A crop of white cholum on a plot adjoining the last named was soon afterwards attacked; to this field the germs were most probably carried by the wind from the diseased yellow cholum field. The crops in the two fields were so severely attacked that the plants were entirely covered with the red powder and soon afterwards withered, dried up, and died before they were fully developed. The white cholum did not come into ear, so that no grain was obtained, and the straw also had lost much of its value as fodder for cattle.

13. Neither smut nor ergot were noticed during the year.

14. The cholum seed sown was all dressed with sulphate of copper at the rate of 4 ounces per 100 lb. of seed. The dressing with sulphate of copper which

destroys the spores of the smut is of course ineffective against the attacks of rust, the spores of this parasite not being adherent to the grains.

15. *Insect attacks.*—Almost all the cholum crops that had been attacked by rust were afterwards attacked by insects. The insect was a small fly which deposited its egg inside the covering leaves; the number of these flies increased so rapidly that in a few days the plants, which were first covered with rust, became whitened by the covering of insects. The degeneration of the sap was most probably the active cause of the insect attack. The insects attacked the straw only when it was nearly dry.

16. Some of the tobacco grown on the Farm was also attacked by insects. In this case the pest was a small green beetle. The peculiarity of its attack was that it commenced its ravages on the bottom leaves where the stalk springs from the main stem, and from that place rapidly extended its attacks to the higher part of the bottom leaves, and after having destroyed them worked up the plant until the whole was ruined. The plants were covered by a black powder, which, when removed in the first stage of the attack, exhibited the leaf in its normal green state, but when left for a few days, caused the withering of the leaf.

The plants that were raised from Farm-grown seed, which were acclimatized and appeared the most healthy and vigorous, were very little injured. This may be due to the fact that these plants were not so much predisposed to attack on account of their vigor, or because they were more advanced towards maturity and therefore contained more nicotin and consequently yielded a less palatable food for the insects.

17. *Vermin.*—The number of snakes is decreasing every year on the Farm. When going over the land five years ago, snakes might frequently be seen, but now it is a rare occurrence to meet with one. Squirrels, which in previous years made considerable havoc in the cotton fields, have also greatly decreased in number. This is probably chiefly due to the persistent efforts made in killing them down. The number of rats, however, seems greatly to have increased. They did great damage in some fields, especially in the Botanical Garden, where they several times destroyed experimental crops. They were especially destructive to maize crops by exhuming the seed soon after it had been sown. The increase in the number of rats may be partly due to the lesser number of snakes on the Farm, but the great increase in the number of rats last season was a cause of complaint in many parts of the Presidency.

During the past year rewards have been paid for the destruction of—

Cobras	8
Other snakes	130
Squirrels	179
Rats	1,602

18. *Office Work.*—During the year the work was further increased in the Farm office. The number of letters written during the past year was—

Departmental	222
General correspondence	498

19. *Establishment.*—No changes took place in the Farm establishment during the year; and the conduct of all the members of it was on the whole satisfactory.

SECTION II.

CULTIVATION AND CROPS.

20. *Rotations.*—The rotation of crops in field No. 3, referred to in paragraph 16 of last year's report, has been adhered to, the field being sown on the 29th October 1879 with cotton and maize in the usual way. The cotton seed germinated very well, and the plants

First year's cropping.

appeared evenly over the whole field, but the maize plants, the seed of which had been newly imported from America, came up very scantily, and the few plants that appeared did not thrive well, apparently owing to the heat of the sun: had there been a regular cold weather season, the crop would most probably have succeeded. After the American maize had failed, the ridges sown with it were ploughed up and country maize was sown; but this also did not succeed, it being too late to raise a cold weather crop without the aid of irrigation. The cotton however did very well and promises to yield fairly.

Partial failure of first crop.

21. In the rotation referred to in paragraph 17 of last year's report, owing to the unfavorable character of the weather, the raggy did not germinate evenly over the whole field, and although the blanks were resown, the yield was very low. The castor beans, however, germinated very well and the plants appeared evenly over the whole field; they grew luxuriantly until December, when their growth was checked, and they were only able to struggle on until February, when they commenced to die off gradually. The bearing period being so very short, the outturn was only 690 lb. of beans from the whole field. Had not the monsoon rains failed the plants would have grown much larger and the flowering and seeding season instead of ceasing in December, would, in all probability, have continued until May or June, as in previous years, and the outturn consequently have been much heavier.

Re-draining rendered necessary.

22. *Drainage.*—The drains of the plot drained in 1875 were opened in June last, and the pipes examined to ascertain the exact state they were in; it was found that most of the pipes were more or less silted up. The plot, which measures 7,100 square yards or a little less than $1\frac{1}{2}$ acres, and constitutes a portion of field No. 21, is situated at a very low level; and owing to the treatment the land had undergone at the hands of the ryots who formerly held it, the physical conditions of the soil were rendered so bad that nothing would grow on it. To reclaim the land draining was resorted to; but the prospect of success was not very great, owing to the peculiarity of the soil and the low situation of the land. The subsoil consists chiefly of fine sand which, after the drains had been dug, was constantly driven into them by the water in forcing its way into the drain. The drains were allowed to remain open for several weeks before the pipes were laid to get rid of the water, which was oozing out from their sides, but it was impossible to get them dry and to obtain a firm bed for the pipes. The workmen from their inability to work with draining tools had to stand in the drains when digging them and when laying the pipes, and thereby made the matter worse. Indeed the soil at the bottom of the drains had in some places more the consistency of a paddy bed fit to receive seedlings than that of a soil ready to receive drain pipes. A layer of clay turf which was laid at the bottom of the drains to serve as a bed for the pipes could only partly neutralize the bad effects of the marshy bottom. This caused the pipes to sink unevenly and to become deranged in their junctures, thus allowing the ingress of soil.

Difficulties in laying pipes.

Small amount of fall available.

23. Bad though the execution of the work was it would not have been sufficient to ruin the drainage in so short a time, had it been possible to give a great fall to the pipes, but unfortunately little fall was available; the surface of the field being nearly level and only a few feet above the bed of the nullah into which the water was discharged. If the trenches could have been left open for some months longer, until they had run dry, a somewhat firmer bed for the pipes would have been obtained, but this practice, which in similar cases is often resorted to in Europe, cannot well be adopted in this country, because showers of rain, which are here usually much heavier and therefore generally more destructive than in Europe, would not only cause the sides of the drains to fall in, but each drain by acting as an open surface water channel would quickly widen and assume the character of a nullah, whereby the field would be much injured.

Depth of drains.

24. The pipes used were manufactured on the Farm. For the parallel drains 2-inch pipes and for the main drain pipes measuring 4 inches in diameter were used. The depth at which the pipes were

laid was from 3 feet to 3½ feet for the parallel drains, and from 4 to 5 feet for the main drain. As the field is nearly level the pipes were not laid so deeply at the upper end of the trenches as at the junction of the parallel drains with the main drain, in order to provide more fall. The distance apart at which the parallel drains were cut was 25 feet. The silt probably got into the pipes after the occurrence of the first heavy rain after they were laid.

Improved texture of the soil.

25. A striking improvement in the physical condition of the soil was, however, observed when the drains were opened. The soil, which before was of close texture, had become more open and friable and indicated great amelioration. The subterranean water level was only about 1 foot lower than the level of the pipes, yet in most places the soil near the pipes appeared well aërated and free of any superabundance of water. Indeed the soil taken out from the drains had the appearance of one which has been subjected to tillage for a long time. The reopening of the drain which caused so much labor in the first cutting was a comparatively easy task; this time no water being met with at any place.

Plan adopted on re-draining.

26. As there were indubitable signs of the possibility of improving the land by drainage it was decided to redrain the land. To avoid the cause of the previous failure, a greater fall was given, which necessitated, however, the making of the outfall of the main drain at rather too low a level. The top end of the drains was not sunk so deeply as before. By this means it was possible to give the main drain a slope of 2 feet per 1,000 and the parallel drains a fall of 3½ feet per 1,000. To prevent the unequal sinking of the pipes and also, as far as possible, the ingress of soil, the junctures of the pipes were covered with collars each 4 inches long; and three deposit cisterns were built in the main drain to catch the silt, if any should enter the pipes; moreover the proper junction of parallel and main drain was effected by using junction pipes, that is, pipes which have the first branching pipe of the parallel drain fixed to the pipe of the main drain. The pipes of the parallel drains were made to branch off from that of the main drain from the top and not from the side as it is often the practice; by this means the earthy matter in suspension will not be deposited when entering the pipes of the main drains, because the water on falling down into the pipe of the main drain attains thereby sufficient velocity to prevent any silting. When re-draining the land the old drains were used, which however had partly to be filled and the pipes previously used were again laid. The work was carried out by day labor; in opening the drains one cooly could easily dig a drain 100 feet long 3½ feet deep in a rough manner. The following exhibits the cost of re-draining the land, exclusive of the cost of pipes :—

Cost of the work.

	RS.	A.	P.
Opening of 3,000 running feet of drain trenches, and filling drain ...	10	15	6
Building one outfall and three cisterns 6 feet deep—			
20 parahs of lime	5	14	0
200 large bricks	3	0	0
3 shutters	2	0	0
Bricklayers' labor	7	8	7
Cart-hire for bricks, sand, &c.	1	0	0
Total Rs. ...	30	6	1

which is at the rate of Rupees 20 per acre. The charge for labor is certainly very moderate; the cost being only 2·1 pies per running yard, in Germany the price paid for draining 6–7 feet deep being 15 pies per running yard. It must however be borne in mind that the soil was in a very favorable state for digging and the weather very fine.

Value of deposit cisterns.

27. That the construction of deposit cisterns in the main drain was not superfluous was shown after the first heavy shower of rain; on the 6th October 3·05 inches of rain fell when it was found that the deposit accumulated measured about a foot in depth in each cistern; in one

the deposit was so great that it filled the cistern to a much higher level than that of the pipe. The silt was removed, and no soil has been deposited since that time.

28. The drainage made in 1873, referred to paragraph 18 of the last report, was found in a similar state to that mentioned above; the pipes being all more or less silted up. Although the pipes were silted up, it was, however, repeatedly observed during the year that the main drain discharged a considerable amount of clear water. This is probably owing to the formation of water-courses near the pipes by means of which the under water is conveyed through the drains and discharged at the outfall.

Value of heavy ploughs in dry weather.

29. *Trench-ploughing.*—The weather being favorable during August and September for field operations, nearly all the land prepared for cold weather crops at that time was ploughed to a depth varying from 9 to 14 inches. It was found that some of the ploughs obtained from Sweden of the English model are admirably adapted for deep ploughing, and they were nearly exclusively used for this purpose; indeed they were almost the only ones that could be effectively used, especially at a time when the soil had become dry and hard. Some of the ploughs turned a furrow 14 inches wide and 12 inches deep, thus moving 13 cubic yards of soil in every 100 yards travelled. The draught was necessarily heavy, and commonly two pairs of cattle were used, except when the pair of buffalo bulls were used, which on account of their great strength were able to do the work by themselves. Sometimes the soil was so hard that the light iron ploughs could not penetrate into the soil and even a subsoil plough following these ploughs did not make good work, but, on using the heavy ploughs referred to with two pairs of cattle, the hard pan lying a few inches below the surface was broken through and a moist subsoil was sometimes turned up; in this case one deep ploughing effected more than two or three ploughings with a light plough.

Benefits of proper ploughing.

30. These ploughings no doubt were very beneficial to the land, but the effect on the first crop grown was not always good. At other times after a shower of rain, when the surface was too wet for ordinary ploughing, by ploughing deeply a drier soil was turned up from below, which on being mixed with that on the surface produced a sufficiently moist seed bed, and a soil dry enough to admit other operations, such as harrowing, &c., being performed. By this means not only could sowing be earlier effected than would have been possible had the land not been so deeply ploughed; but the moisture thus distributed through a great body of soil was more fixed, it being well known, and has been shown in experiments made with various soils on this Farm, that the rate of evaporation is much greater from a soil saturated with water than from one which is only moderately moist.

Value of deep cultivation still further demonstrated.

31. There can be little doubt that the comparatively good yield of some of the crops raised last year under the adverse circumstances previously referred to must be chiefly attributed to deep ploughing, especially in cases where the subsoil had been in a measure prepared for it, by subsoil ploughing and heavy manuring in previous years. The beneficial effect of it was most strikingly exhibited in field No. 33, which had been twice deeply ploughed, in which a crop of horse-gram was sown on the 16th January. The seed germinated freely and the plants grew luxuriantly all over the field, except at the head lands, which had been less deeply ploughed, and the soil of which had been more or less consolidated by the frequent treading of cattle. Close by another field which had not been so deeply ploughed was sown with horse-gram at the same time. The seed in this case also germinated regularly but the plants ceased growing and perished soon after they appeared above ground on account of the insufficiency of moisture.

32. That a deeply stirred soil condenses and retains more water than one only moved to a slight depth was repeatedly observed on this Farm during the year. Land that had been once deeply ploughed could be easily ploughed subsequently during the dry season, and the soil in these cases was much more friable and

contained much more moisture than the soil of fields that had not been so deeply ploughed.

Caution to be observed in deep ploughing.

33. Caution should however be exercised in adopting deep ploughing; thus—land whose surface soil is poor, and having a subsoil poorer still and which cannot be enriched by a liberal supply of manure; and again soils, which contain much clay, or whose subsoil contains much iron in the form of protoxide, may be rendered barren for considerable length of time by adopting *deep ploughing* suddenly. The soil on this Farm is mostly of a sandy or sandy-loamy character and may generally, without running great risk, be ploughed deeply; the porous soil admitting easy access of atmospheric air is easily ameliorated, especially when liberally manured. The surface soil being however generally richer than the subsoil in the case of the partially improved soils, by ploughing it down temporary loss may be incurred.

Subsoiling the safest plan.

34. "Liberal manuring" is the key to success, and when adequate supplies of manure are available deep ploughing on such a soil may be adopted without fear. On the whole there is less risk of injuring the land by deepening the furrow by means of the subsoil plough than by trench-ploughing. Especially for salt lands the value of deep subsoil ploughing cannot be overrated; for if the soil is made very loose to a great depth the capillary tubes become so large that the injurious salts are unable to rise to the surface; and those also which may be in the surface soil will be washed down into the subsoil thereby rendering the surface soil fit for the growth of plants.

UNIRRIGATED CROPS.

35. The following table shows the yield of crops raised last year without the aid of irrigation. It is to be seen that some of the crops yielded fairly, considering the unfavorable season experienced.

Number.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.	
				Date.	Amount of Seed sown.	Seed sown per Acre.	Date.	Outturn.					Inches.	Wet Days.
								Grain or Seed.	Straw or Fodder.	Grain per Acre.	Straw per Acre.			
			ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.		
	Cereal Grain Crops.													
1	Yellow cholum	15-I. ...	4·1	12th October 1878 ...	73	17·8	15th February 1879 ...	1,775	24,709	433	6,027	126	4·74	20
2	Do.	15-II. ...	3·2	15th October 1878 ...	123	38·4	20th February 1879 ...	783½	18,392	244	5,748	128	4·60	19
3	Sorghum saccharatum ...	18 ...	4·82	14th October 1878 ...	95	19·7	17th February 1879 ...	2,038	26,566	423	5,509	126	4·60	19
4	Planter's friend	17 ...	1·93	10th October 1878 ...	45	23	4th February 1879 ...	1,216	22,168	680	11,486	117	4·74	20
5	Raggy	16 ...	2·41	17th September 1878 ...	44	18	25th December 1878 ...	60	1,830	25	759	99	11·01	25
6	Cumboo	21-*a* ...	1·5	19th July 1878 ...	30	20	20th September 1878 ...	338	10,920	225	7,280	71	31·41	28
	Cereal Fodder Crops.													
7	Planter's friend	17 ...	2·37	10th October 1878 ..	55	23	14th December 1878 ...	...	11,780	...	4,970	65	3·62	13
8	Yellow cholum	34-*a* ...	1·87	16th October 1878 ..	50	26	28th December 1878 ...	...	24,880	...	13,305	73	3·71	14
9	White cholum	32 ...	4·25	3rd October 1878 ..	95	22	18th January 1879 ...	...	36,537	...	8,597	107	9·79	21
10	Do.	10-*b* ...	2·18	18th September 1878 ...	50	22	8th November 1878 ...	...	6,780	...	3,110	51	8·59	13
11	Do.	10-*b* ...	2·18	9th November 1878 ...	50	22	1st March 1879 ...	...	27,190	...	13,199	112	3·96	15
12	Sorghum saccharatum ...	10-I. ...	2·128	10th September 1878 ...	50	23	11th November 1878 ...	...	22,537	...	10,590	62	9·43	17
13	Tenney and dholl	11-*b* ...	2·66	16th October 1878 ...	73	27	8th December 1878 ...	...	11,315	...	4,254	53	3·29	10
14	Guinea-grass	27 ...	2·11	4th November 1878 ...	...	...	31st January 1879 ...	...	3,780	...	1,791	88	2·99	15
15	Do.	23-*a* ...	5·96	2nd November 1876 ...	...	...	5th October 1878 ...	20	7,830	3	1,314	702	91·2	125
16	Do.	3 ...	1·78	...	...	...	2nd July 1878 ...	...	4,100	...	2,303	...	...	...
	Leguminous Pulse Crops.													
17	Black gram	19-*b* ...	1·18	3rd December 1878 ...	18	15	25th February 1879 ...	49	1,160	42	983	84	1·19	9
18	Horse do.	19-*b* ...	1·18	3rd December 1878 ...	48	40	15th March 1879 ...	107	1,216	91	1,031	102	1·19	9
19	Black do.	25 ...	1·68	19th October 1878 ...	54	32	19th February 1879 ...	85½	1,140	51	679	113	3·96	16

Number.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.	
				Date.	Amount of Seed sown.	Seed sown per Acre.	Date.	Outturn.					Inches.	Wet Days.
								Grain or Seed.	Straw or Fodder.	Grain per Acre.	Straw per Acre.			
			ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.		
	Leguminous Fodder Crops.													
20	Horse-gram and cumboo ...	13 ...	2·73	19th July 1878 ...	70	25	20th September 1878 ...	...	25,473	...	9,330	63	12·81	25
21	Do. do. ...	14 ...	3·47	5th July 1878 ...	77	22	18th September 1878 ...	...	28,960	...	8,346	75	13·36	26
22	Horse-gram	15-*a* & *b*.	7·30	30th July 1878 ...	161	22	18th September 1878 ...	...	59,130	...	8,100	69	12·81	25
23	Do.	17 ...	4·90	12th July 1878 ...	92	19	11th September 1878 ...	...	24,500	...	5,000	61	11·97	21
	Fibre and Dye Crops.							Seed cotton		Seed cotton				
24	Cotton	10 ...	2·12	10th September 1877 ...	39	18	1st July 1878 ...	1,215	...	591	...	294	38·41	45
25	Do.	33 ...	4·75	1st September 1877 ...	20	5	1st July 1878 ...	1,386	...	291	...	277	42·14	50
26	Do.	1 ...	·95	26th September 1878 ...	7	7	...	...	...	...	...	...	13·30	29
27	Do.	3 ...	1·78	28th September 1878 ...	20	11	...	...	...	...	...	...	13·03	28
28	Do.	4-I ...	3·18	12th September 1878 ...	25	8	...	...	...	...	...	...	14·22	34
									Bundles.		Bundles.			
29	Indigo	16 ...	4·82	26th November 1877 ...	32	6	28th February 1878 ...	...	291	...	60·37	94	3·46	7
							21st May 1878 ...	...	83	...	17·22	82	3·57	6
							14th August 1878 ...	...	201	...	41·70	85	10·07	17
30	Do.	32 ...	4·25	27th November 1877 ...	58	13	7th March 1878 ...	...	211	...	50	100	3·46	7
							21st May 1878 ...	...	218	...	51	75	3·57	6
							7th August 1878 ...	...	339	...	80	78	3·56	11
31	Do.	14 ...	3·47	5th December 1878 ...	80	23	5th March 1879 ...	...	72	...	20·7	90	1·14	8
	Oil Seed Crop.													
32	Castor beans	16 ...	2·41	17th September 1878 ...	30	12	24th February 1879 ...	690	...	286	...	160	11·58	28

36. *Yellow Cholum, Nos.* 1 *and* 2.—These crops were raised in the field referred to in paragraph 31 of the last report, it produced a very good crop of horse-gram which was ploughed in as a green manure shortly before the cholum was sown. The outturn of grain, 433 lb. per acre, from No. 1 is good, considering the adverse season during which the crop grew, the rainfall being only 4·74 inches, and the sky was nearly always clear and bright from the very commencement. The yield however would have been much greater had the vitality of the seed been better; the plants appeared unevenly over the ground, and the crop was patchy in several places, especially in those that had been stripped of the surface soil to a considerable depth. The individual plants were however very well developed over nearly the whole area: the stalks were very thick and many of the heads attained an extraordinarily large size. The grain was generally small; this was evidently due to the insect attack with which the crop suffered; most of the heads being very close harboured a great number of insects. It was observed that the grain in the heads that were most attacked exuded a glutinous substance before they matured; this caused them to shrivel more or less when ripening, thereby reducing the yield. The plot on which No. 2 grew having been made up of portions of several fields, including a road, is of very varied quality and part of it is in very low manurial condition. The horse-gram crop was also ploughed in as manure in this plot as in plot No. 1. The outturn, 244 lbs. per acre, is low: this is chiefly due to the poverty of the soil and perhaps in some measure to the different mode of interculture adopted. The seed in plot No. 1. being sown in lines alternately 6 and 24 inches apart, admitted of the use of the plough, instead of the horse-hoe for cultivating between the rows, but although this system is more economical, it is doubtful whether it is in all cases advantageous.

Good crop with small rainfall.

37. On plot No. 2 some experiments were made to ascertain the best distance apart at which to sow this crop; and the results are given below:—

Number.	Seed sown in lines.	Outturn. Average for 2 Plots. Grain.	Outturn. Average for 2 Plots. Straw.	Outturn. Per Acre. Grain.	Outturn. Per Acre. Straw.
		LB.	LB.	LB.	LB.
1	9 inches apart	67	1,461	322	6,957
2	12 do.	69	1,278	328	6,085
3	18 do.	61	1,404	294	6,686
4	24 do.	63	1,274	303	6,086
5	Alternately 6″ and 18″ apart ...	64	1,265	305	6,026
6	Broad-cast	26	1,040	123	4,952

In every case the plots were duplicated; the average outturn is given and by this means the errors likely to creep in from the varied nature of the soils of the field are in a measure neutralized; the area of the plots was ·21 acre. The figures tend to show that in a season like the past one, it is best on our soils to sow this crop in lines about 12″ apart; at this distance the highest yield of grain was obtained; but it is observable that the most valuable crop was obtained when the lines were placed only 9″ apart; however the greater economy of working, when the lines are only 12″ apart, more than compensates for the smaller yield. The relative values of the crop obtained per acre from plots Nos. 1, 2, and 3 were as follows:—

—	No. 1. RS.	No. 1. A.	No. 1. P.	No. 2. RS.	No. 2. A.	No. 2. P.	No. 3. RS.	No. 3. A.	No. 3. P.
Grain	10	11	9	10	14	11	9	12	10
Straw	23	3	0	20	4	6	22	4	7

From this it will be seen that the most valuable crop was most closely sown. It is however necessary to note that the duplicate plots presented great variance and in the

case of one plot sown in lines alternately 18 and 6 inches apart, the highest yield of grain of all was obtained.

Most striking however is the clear demonstration of the inadvisability of sowing such a crop broadcast. On the broadcast plot the yield of grain was scarcely more than one-third and that of straw a little more than two-thirds only of the yield from plot No. 1. The cost of hoeing the crop was also much greater in the case of this plot, as it all had to be done by manual labor. The value of the whole crop per acre in this case was only Rupees 20-12-8.

38. *Sorghum Saccharatum, No.* 3.—Grew in the field referred to in paragraph 25 of last year's report; the field however has been enlarged on its eastern side, and the soil of the piece added is of poor quality, consisting mostly of coarse sand. The outturn, 440 lb. of grain per acre, however, is fair. Had the crop grown on the head lands and on the piece newly added, where the crop was inferior, been separately calculated the figures showing the yield per acre of the remaining portion would be much more favorable. Great damage was also done to the crop by rats. As *Sorghum* does not ripen uniformly and the time of harvesting extends over several weeks, it is difficult to prevent entirely such losses.

39. *Planter's Friend, No.* 4.—This followed a crop of horse-gram, which had been ploughed in as green manure before the Planter's friend was sown. The field, No. 17, was levelled two years ago; the soil is poor and very variable, and all of it was in a very low manurial condition. The crop grew on the north-eastern portion of the field, the soil of which is rather better than the rest. The whole field had been sown with Planter's friend seed, but the plants grown on the more sandy soil being very much attacked by rust were cut for green fodder. The outturn of grain is very satisfactory, and it must be remembered that this was obtained from an inferior soil, with a rainfall of only 4·72 inches. The short time required to attain maturity is also worthy of notice.

40. *Raggy, No.* 5 *and No.* 32, *Castor beans*—Have already been referred to in paragraph 21.

41. *Cumboo,* No. 6.—This crop was grown on a soil consisting chiefly of fine sand and in low manurial condition: the outturn of grain is not heavy; it is however satisfactory as the crop was on the land only 71 days. A crop that can be raised in so short a time, although the outturn may not be very high is, as a hot weather crop, often of greater value than one that yields more heavily but requires a long time to attain maturity, on account of which it cannot be grown in fields that have to be prepared for the cold weather crops.

42. *Planter's Friend,* No. 7.—This was grown on the sandy portion of field No. 17 and was cut down early when the plants were not fully developed because they were severely attacked by rust. The outturn is consequently rather low.

43. *Yellow Cholum, No.* 8.—The outturn is very satisfactory, considering that the crop was only 73 days on the ground and the rainfall only 3·71 inches. The yield, however, would have been much heavier had the crop been cut before it was attacked by rust, which caused the drying up of the plants in the greater part of the field. The figures consequently represent more correctly the outturn of dry straw than of green fodder. The good outturn in this case was undoubtedly chiefly due to deep ploughing, for the yield of the head lands, that were much less deeply ploughed, was much less than that of the other parts of the field; the rust appeared also fully two weeks earlier on the crop grown on the head lands than elsewhere; and probably the disease spread from them over the plants growing on the remaining portion of the field.

44. *White Cholum, No.* 9.—This crop was very much attacked by rust and the straw was nearly half dry when it was cut, which accounts partly for the comparatively low yield. In some parts of the field the crop was very good, but the plants were very small on the head lands, this part of the land having been less deeply ploughed than the remainder. Under the shade of the tamarind trees the crop was also very inferior. The following table shows the yield of some of the better portion of the field as well as the outturn under the shade of a tamarind tree :—

—	Area.	Outturn.	Outturn per Acre.
	SQ. YDS.	LB.	LB.
Centre part of the field ...	100	528	25,355
Under the shade of a tamarind tree.	1,111	856	3,729

No. 10.—This crop was grown on soil which is a sandy loam and with reference to its physical qualities one of the best met with on the Farm, but is in low manurial condition. *No.* 11.—This was grown on the same plot as crop No. 10. The seed was sown a day after the preceding crop was harvested; the land, however, was deeply ploughed and well prepared by means of the harrow, &c. The outturn, 13,199 lb., is very good, considering the small rainfall and the bright sky predominating during the time of growth. The soil had evidently benefited by the interculture of the preceding crop and the deep ploughing before sowing.

45. *Sorghum saccharatum, No.* 12.—The outturn, 10,338 lb. per acre, is tolerably good. The field, however, is a good one, and the soil was well prepared; the weather was very favorable for the growth of crops. It is worth notice that the crop stood only 62 days on the ground.

46. *Tennay and Dholl, No.* 13.—This crop was sown on a soil of varied quality and was cut out before fully matured.

47. *Guinea-grass, No.* 14.—The land on which the crop grew is the more sandy portion of the field. The whole field was planted, but only the roots planted first, at a time when the sky was somewhat cloudy, struck root. The larger portion of the field failed entirely. The outturn, 1,791 lb. per acre, is satisfactory, considering the short time the roots have been put down and the little rainfall. A second crop was nearly fit for cutting at the end of March.

Nos. 15 *and* 16.—Only one cutting was obtained during the year, when a small portion was also allowed to run to seed from which 20 lb. of seed was obtained. The Guinea-grass, grown on these fields, afforded grazing for the sheep nearly throughout the whole year. The grass thus consumed has not been estimated.

48. *Black-gram and Horse-gram, Nos.* 17 *and* 18.—Grew on two different sides of the same field, the soil of which is throughout very poor, consisting chiefly of coarse sand; the crop however appeared healthy during the whole time of its growth, but the plants were all small, hence the low outturn. *No.* 19—was a crop produced on a very poor piece of land.

49. *Horse-grain and Camboo, No.* 20.—These crops were sown mixed, with the idea that the cumboo plants would afford support to the horse-gram and keep it off the ground. The outturn, 9,330 lb. per acre, is very good, considering that it was produced in only 63 days: the weather however was during the time very favorable.

No. 21.—This crop grew on a field part of which is in a very poor manurial condition; the outturn however is fair.

50. *Horse-gram, No.* 22.—This crop was grown in the same field as crops Nos. 1 and 2; the outturn, 8,100 lb. per acre, is certainly very satisfactory. The result was undoubtedly partly due to deep ploughing before sowing; the weather was also very favorable. The crop was ploughed in as green manure; the produce of a plot being weighed off and from this the outturn of the whole field estimated.

No. 23.—This crop was grown on the field which produced crops Nos. 4 and 7. The outturn was estimated.

51. *New Orleans Cotton, Nos.* 24 *and* 25.—These two crops were shortly referred to in paragraph 28 of last year's report. In the following table the yield of seed-cotton, as well as that of lint, is given:—

Month during which received.	Amount of Seed-cotton received from the Field.				Amount of Clean Cotton received.				Percentage of Clean Cotton and Lint obtained from Cotton in Seed.	
	No. 10 Field.		No. 33 Field.		No. 10 Field.		No. 33 Field.			
	Total in Month.	Percentage of Year's Crop.	Total in Month.	Percentage of Year's Crop.	Total in Month.	Percentage of Year's Crop.	Total in Month.	Percentage of Year's Crop.	No. 1	No. 33.
1877.	LB.		LB.		LB.		LB.			
December	1	·08	253·5	17·43	·25	·07	69	16·04	25	27·22
1878.										
January	...	...	201·5	13·86	...	...	57	13·25	...	28·29
February	...	...	10	·69	...	...	3·25	·76	...	32·50
March	268	22·27	361	24·82	79	21·98	115	26·74	29·48	31·86
April	440	36·58	170·5	11·72	146	40·62	46	10·69	33·18	26·98
May	89	7·40	134	9·21	26	7·23	44	10·23	29·21	32·84
June	371	30·84	294	20·21	98	27·27	87	20·23	26·42	29·59
July	34	2·83	30	2·06	10·16	2·83	8·87	2·06	29·88	29·57
Total ...	1,230	100·00	1,454·5	100·00	359·41	100·00	430·12	100·00	29·88	29·58

From these figures it will be seen that after June in neither case was any considerable portion of the crop obtained, thus confirming the belief that it is advisable to remove the cotton crop in July.

It will be remembered that the low percentage of cotton obtained in the early ginnings was explained by the fact that the cotton-in-seed when received from the field is, during the early months of the year, always charged with a considerable amount of moisture. The outturn from field No. 10, 169·5 lb. of lint per acre is good.

52. *No.* 26.—This crop was sown on a somewhat sour piece of land, where previously great difficulty has been experienced in producing good crops; the soil is of very close texture but appears to be tolerably well adapted to the growth of cotton. The plants commenced to bear at the beginning of February, the yield 177 lb. of seed-cotton per acre up to the end of March is satisfactory. The complete results will be given next year. The cholum that had been sown between the lines of cotton did not succeed; most probably on account of the soil being too sour.

No. 27.—The soil on which this crop was produced varies very much; in some parts it is stiff, in others more sandy; the field was never levelled and its surface has many depressions, so that after rain at a time when some parts of it are too wet, others are too dry for field operations. This drawback was remedied partly by subsoil drainage for a time, but the pipes having become choked up, the field has partially returned to its old state. The cotton plants did not therefore grow uniformly throughout the field and most of them attained only a small size. The outturn 189 lb. of seed cotton up to the end of March is, considering the drawbacks under which the crop labored, not bad. The result of this crop cannot be recorded fully this year.

No. 28.—This crop will be referred to fully under Section III, as some experiments were made in it with different manures. The results of the ginning, of the produce of the 3 crops last referred to, will be given next year.

Season a bad one for Indigo.

53. *Indigo, Nos.* 29 *and* 30.—These crops were referred to in paragraph No. 30 of last year's report. It is noteworthy that the first cutting in field No. 16 was the heaviest, whereas in No. 32 the third cutting was the heaviest. The yield of both these cuttings was satisfactory, but the yield of the other cuttings, especially that of the second cutting in field No. 16, was very low. In general the yield of the second cutting is

the best. The low yield of the second cutting in No. 16 was due to the land having been recently levelled and its soil being very poor; the dry weather in April and early part of May killed many plants; the heavy rain that fell during the latter part of May had a very beneficial effect for the third cutting in field No. 32, as on account of the soil being good none of the plants had died, but it did not very much affect the third cutting in No. 16 because many of the plants had died before the second cutting.

No. 31.—This crop followed a crop of cumboo and horse-gram fodder which followed one of *Sorghum saccharatum;* that referred to in paragraph 29 (No. 14) of last year's report. The soil of this field is rather varied and uneven in quality. That part of the field which had previously been a plantain garden yielded fairly at the first cutting but in some of the remaining parts the yield was very low. The results of this crop will be given fully next year.

IRRIGATED CROPS.

Failure of the Mylapore Tank.

54. In the table given below the results of the crops grown by aid of irrigation are shown. The water was all raised by machinery. The Mylapore tank, from which irrigation water in ordinary seasons is obtained by gravitation for the paddy grown on the northern part of the Farm, was nearly dry throughout the whole year. This water under favorable circumstances lasts about seven months, so that by means of it two crops of paddy can be raised; but last year no water reached the Farm by gravitation. As there was a little water in the tank during the months of October and November some picottas were erected at the sluice to raise the water required to start the paddy crop. At that time it was expected every day that the monsoon would break and that the water in the tank would soon rise sufficiently high to flow to the paddy beds by gravitation; an expectation that was not realized. The little water in the tank was exhausted before the crops were half matured, and the single well available afterwards soon ran dry. The consequence was that, after expending about Rupees 100 for raising water, about ten acres of paddy withered; most of it yielding no grain at all and only a very poor outturn of straw for cattle fodder. In every case the irrigation was only occasional.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing. Date.	Sowing. Amount of Seed.	Sowing. Seed per Acre.	Details of Harvesting. Date.	Outturn. Grain.	Outturn. Straw.	Outturn. Grain per Acre.	Outturn. Straw per Acre.	Duration of Growth.	Rainfall. Inches.	Rainfall. Wet Days.
	Cereal Grain Crops.		ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.		
1	Car paddy	35-*g*	·34	15th July 1878	Planted.		8th October 1878	181·5	2,503	534	7,362	85	19·65	34
2	Carolina paddy	36-*c*	·77	15th August 1878	Do.		4th December 1878	48	2,160	62	2,805	111	16·33	33
3	Seroomony paddy	37-*a*	·62	4th September 1878	15	80	3rd February 1879	57	3,680	92	5,935	152	15·46	37
4	Do.	35-*f*	·99	22nd August 1878	40	40	24th January 1879	224	1,786	226	1,804	155	17·00	39
5	Car paddy	R.F.-I.	·94	9th March 1878	Planted.		25th May 1878	324	1,624	409	1,728	77	3·57	6
6	Do.	R.F.-I.	·94	26th June 1878	Do.		10th October 1878	730	4,680	777	4,979	106	21·80	37
7	Do.	R.F.-II.	·66	16th February 1878	Do.		27th May 1878	226	1,400	342	2,121	100	4·57	7
8	Do.	R.F.-II.	·66	14th June 1878	40	60	10th October 1878	770	3,920	1,167	5,939	118	21·80	37
9	Madagascar paddy	35-II.	·60	18th October 1878	22·5	37·5	7th April 1879	111½	1,340	185	2,233	171	6·01	19
10	Ragi	35-I.	·35	19th do.	11	31	23rd January 1879	116	1,680	331	4,800	96	3·96	16
11	Maize	8	·28	17th do.	8	28	23rd December 1878	5,716*	2,232*	20,414	7,921	67	2·16	12
12	Do.	8	·61	31st December 1878	20	33	13th March 1879	9,200*	3,124*	15,082	5,121	72	2·77	7
	Cereal Fodder Crops.													
13	Yellow Cholum	8	·68	5th May 1878	60	88	18th September 1878	...	15,332	...	22,547	136	18·76	33
14	Do. 1st cutting	12-*b*	·83	11th do.	50	69	31st July 1878	...	12,740	...	15,349	81	7·22	12
	Do. 2nd cutting						30th September 1878	...	16,308	...	19,648	61	12·14	24
15	Do.	20-I.	·89	7th June 1878	60	67	24th August 1878	...	22,072	...	24,800	78	9·54	18
16	Do.	20-II.	·37	30th July 1878	35	94	31st October 1878	...	3,780	...	10,216	93	19·16	33
17	Do.	23-II.	1·5	20th do.	40	26	6th November 1878	...	17,977	...	11,985	109	21·40	38
18	Do.	35-II.	·6	18th May 1878	30	50	1st August 1878	...	9,812	...	16,353	75	5·49	11
19	Cumboo	22	1·75	25th do.	37	21	25th July 1878	...	7,303	...	4,173	61	4·42	9
20	Sorghum	12-*b*	·83	28th November 1878	25	30	1st March 1879	...	2,865	...	3,452	93	2·77	11
21	Car paddy	R.F.-*c*	·54	16th March 1878	32	59	17th June 1878	...	1,694	...	3,137	93	4·57	7
					Shoots.	Shoots.								
22	Sugarcane	1-*a*	·72	31st January 1878	5,000	6,944	29th January 1879	...	6,799	...	9,444	364	31·11	64
23	Do.	1-*b*	·72	30th March 1878	5,000	6,944	30th December 1878	...	6,696	...	9,300	275	30·39	60
	Vegetables and Fruits.													
24	Plantains	12-*a*	1·68	19th September 1876	Planted.		31st March 1879	...	493†	...	293†	922	104·23	156
25	Sweet potatoes	4-3	1·25	7th September 1878	Do.		15th do.	...	2,451‡	...	1,966‡	189	12·77	34
26	Brinjals	11-*a*	·21	15th February 1878	Do.		4th June 1878	...	1,172§	...	5,582§	110	4·57	7
27	Do.	11-*a* & *b*.	·41	15th do.	Do.		3rd September 1878	...	1,122·5§	...	2,738§	200	15·66	28
28	Chillies	11-*c*	·13	16th March 1878	Do.		1st June 1878	...	72§	...	554§	77	4·57	7
29	Tobacco	8	·50	19th December 1878	Do.		3rd March 1879	...	...	...	...	...	...	...
30	Do.	8	·70	22nd February 1878	Do.		4th May 1878	...	1,016‖	...	1,450‖	195	17·35	40

* Cobs. † Bunches. ‡ Tubers. § Fruits. ‖ Dry leaf.

55. *Paddy—Nos.* 1 *to* 4.—These crops were grown on land, situated at the northern end of the Farm, which chiefly depends for its irrigation water on the Mylapore tank ; the low outturn of grain may be chiefly attributed to the tank having been empty throughout the year. Crops that required a long time to mature suffered most, and the yield was consequently low. Sirumoni paddy is often cultivated because it commands a higher price, and thus yields a higher return, but, as it requires a long time to mature, the cost of production is necessarily much greater than that incurred in raising a crop maturing in a shorter time. The Sirumoni paddy grown on the Farm required 152 days in one field and 155 days in another to reach maturity. The water required for irrigation was all raised by means of picottas. The cost of irrigating the crop in this manner for the long period was very great, greater indeed than the sum that would have been realized if a fine crop of paddy had been raised.

Nos. 5 *and* 6.—These crops were obtained from one field at different seasons. The outturn, especially of the first crop, is low ; this may be chiefly attributed to the frequent cropping of the field and the low level of its surface. The field is badly drained, it being nearly at the same level as the river which constitutes its southern boundary.

Nos. 7 *and* 8.—These crops also were raised on the same land at two different seasons. The yield of the first crop was like that of the preceding case low, but the second crop was tolerably good. The land on which these crops were raised is situated east of the plot mentioned in the preceding paragraph and at the same low level. The paddy grown in the river-bed can be raised without undergoing a great expenditure for raising water, but there is a risk that the crop may be destroyed by being flooded whenever the river rises slightly. The land requires frequent manuring because the flood-water that passes over it not only washes over the land but often carries the surface-soil away bodily and in it the fertilizing matters.

56. *No.* 9.—This crop was raised from seed received from Madagascar. The habit of the plant is quite different to any paddy crops raised on the Farm previously. It is especially remarkable for its broad leaves which gives the plants a bushy appearance. The low outturn is chiefly due to the low vitality of the seed ; the plants appeared very unevenly above the ground and the crop was very patchy : they however grew very well and attained a great height ; and as they stood far apart they tillered profusely. It was first thought that the Carolina paddy was of this variety ; however the seed differs much from that of the Carolina paddy being narrow and not possessing the golden color which is a peculiarity of that paddy. This variety of paddy owing to its bushy habit might be a good fodder-producer for live-stock but the cost of raising it is very great on account of the long time required to mature it.

57. *Ragi* (*Eleusine corocana*)—*No.* 10.—This crop was raised in a field situated at the northern end of the Farm. The crop varied very much in different parts of the plot ; it grew very well in those places whose surface had never been disturbed but was poor in those that had been stripped of their surface soil. It was sown on the 19th October 1878 and was watered about once in 16 days during its growth. As the harvest-time extended over several weeks most probably a considerable amount of the produce was stolen.

58. *Country Maize—No.* 11.—This crop was raised from seed received from Vellore. The land on which the crop grew is one of the best met with on the Farm, and the maize followed a crop of tobacco, which yielded heavily, and was the first crop after levelling. The deep cultivation under which the tobacco grew was evidently very beneficial for the maize crop. The plants grew to the height of 3 to 5 feet ; the cobs were small, but the number obtained considerable ; the short time required to attain maturity is noteworthy.

No. 12.—This crop was raised on a different plot of the same field as that on which the maize mentioned above was grown. The land is of good quality but not in so good manurial condition as that mentioned above. The maize was preceded

by a very good crop of cholum (referred to in the next paragraph). The plants grew very vigorously and attained a height of about 5 to 7 feet; the number of cobs obtained were less but the cobs were larger than in the previous case; the 9,200 cobs obtained yielded 112 lb. of dry grain. Although the plants were much higher than in the other case the yield of straw was less; this was most probably due to the plants growing in the first case more in thickness than in height; to the soil that had produced the first crop being much better than that which produced the second; and to the first crop being produced in the cold season, and therefore the plants being probably more succulent.

59. *Yellow Cholum—No.* 13.—This crop preceded the maize crop last mentioned; it was one of the best ever grown during the hot season on the Farm. It was sown on the 5th May; the land, having been manured with box-manure at the rate of 8 tons per acre previously, required very little watering and was only ploughed deeply with a common plough between the lines; the plants grew so vigorously that they suppressed all weeds; the crop was fit for cutting fully a month earlier than it was harvested, but the harvest was delayed on account of unfavorable weather. The outturn is very good: a piece of 100 square yards grown in the centre of the field was cut separately, and yielded 1,672 lb. of green fodder, or at the rate of 80,924 lb. per acre. As is usually the case the yield on the head-lands was much less than in the centre of the field.

No. 14.—This crop was obtained in two cuttings. It is noteworthy that the yield obtained from the second cutting was larger than from the first. The outturn of each cutting separately is satisfactory, and the total 34,997 lbs. per acre is very good. The soil of the plot is of poor quality; it was manured with box-manure at the rate of 8 tons per acre which was applied two days before the seed was sown: the seed was sown on ridges and germinated in a few days. The crop was irrigated five times; the land was ploughed twice with a common plough between the lines. After harvesting the first cutting, the land was again ploughed between the lines but nothing further was necessary to raise the second crop.

No. 15.—This crop grew on the land referred to in paragraph 21 of last year's report. The outturn, 24,800 lb. of green fodder per acre, is very good. The crop attained a height of 12 feet, and is the best crop ever obtained from this field. The good yield is chiefly due to the deep cultivation referred to last year.

No. 16.—The land on which this crop grew belongs to the same field as the plot mentioned above. The yield of this plot was not so high as that of Plot No. 1, the land not having been stirred to so great a depth as Plot No. 1.

No. 17.—The soil on which this crop grew being sandy and poor, the outturn, 11,985 lb. of green fodder per acre, is good. The expenditure in raising this crop was small, only a few waterings having been required and as the land remained clean and the soil friable whilst the crop was grown little was done in hoeing the crop except ploughing with a common plough between the lines.

Nos. 18, 19, 20, 21 *and* 22.—These crops do not call for special comment. No. 18 preceded the Madagascar paddy referred to in paragraph 56. No. 21 followed the yellow cholum referred to; the crop being sown in alternate ridges with castor.

61. *Sugarcane—Nos.* 23 *and* 24.—These crops were produced on two different plots of the same field: a full account of their growth is given in Section III.

62. *Plantains—No.* 24.—This is the crop referred to in paragraph 67 of last year's report. During the year the crop was heavily manured with horse manure at the rate of 10 tons per acre; this is the third time that manure has been applied. The outturn during the year was as follows; it is small:—

—	Number of Bunches.	Weight.	Receipts.		
		LB.	RS.	A.	P.
1878.					
April	98	1,384	22	14	0
May	26	262	4	12	0
June	2	20	7	7	0
July	4	36	8	1	0
August	5	55	...		
September	6	60	5	15	9
October	3	33	1	11	0
November	8	88	1	6	6
December	23	267	0	14	6
1879.					
January	27	220	3	11	6
February	39	358	15	3	5
March	121	1,060	11	11	4
Total ...	362	3,843	83	12	0
Total per Acre ...	215	2,287	49	13	7

Owing to the exceptionally dry weather the cost of irrigation was very heavy, 1 bullock with a driver and a boy for guiding the water being solely employed to supply the water needed during the dry season. The expenditure during the year was as follows :—

Year.	—	Total.			Per Acre.		
		RS.	A.	P.	RS.	A.	P.
1878	Planting blanks	0	9	0	0	5	0
	Manure and manuring	15	4	0	8	6	10
	Digging and hoeing	21	3	0	11	11	3
	Watering	50	12	0	28	0	7
	Cutting weeds	2	6	0	1	5	0
	Clearing dead leaves	1	2	0	0	9	11
	Cutting out suckers	2	14	0	1	9	5
	Ploughing between rows	6	12	0	0	6	8
	Total ...	94	14	0	52	6	8
	Value of 362 bunches and sundries received in 1878	96	13	0	53	7	10

63. *Sweet Potatoes, No.* 25.—The land on which this crop grew had been recently levelled, the soil is very varied, being a loamy sand at its eastern side but stiffish at the west end, the latter part having been stripped of its surface soil was not properly fit for cropping at the time when the crop was put down ; the southern part was manured with indigo refuse at the rate of 6 tons per acre and with village ashes at the rate of 12 cart loads per acre ; it grew very well where the soil was sandy but always appeared stunted on the stiffer soil. The outturn recorded in the statement was obtained from the sandy portion of the field; and, considering the poverty of the soil, is not bad. The tubers grown on the stiff soil were not gathered as they were all more or less rotten. The tops of the sweet potatoes were used as cattle food when green; the cattle seemed to be very fond of them; their weight was not ascertained, but may be estimated to be about 6,000 lb. per acre.

64. Brinjals (*Solanum melongena*) and Chillies (*Capsicum annuum*), *Nos.* 27, 28 *and* 29.—These crops preceded the Tennay and dholl referred to in paragraph 46. The land was prepared for their reception at the commencement of February; the plants having been raised in a seed-bed near by. The plants were dibbled in on ridges made 24 inches apart; on both sides of the ridge. The crops were irrigated generally about once in 6 days and commenced to bear about 16 weeks after being planted. The brinjals continued to produce during about 12 weeks, the chillies

during 8 weeks. The outturn of brinjals is large, No. 27 especially so. In the latter case a yield of nearly 3 tons of fruit per acre were produced in about 7 months; the value of this crop was Rupees 66 per acre.

65. *Tobacco—No.* 30.—The following is an account of the experiment referred to in paragraph 78 of the last report of this Farm. The land selected measured three-fourths of an acre; it had been levelled only a few months previously, and laid down at a slope of 1 in 250; in doing this about 1½ feet of the surface-soil was stripped off in some places and raised in others by nearly 2 feet. Excepting this drawback, the field was very well adapted for the purpose, being in close proximity to a well from which it could be easily irrigated and on account of its physical condition, the soil being a friable sandy loam, but it was in very poor condition especially in the parts that had been stripped.

Land selected.

66. The land was ploughed and subsoiled on the 28th May, and was ploughed a second time and harrowed on the 9th June 1877; it was then manured with horse manure at the rate of 12 tons per acre and again ploughed on the 31st July. After a fourth ploughing at the commencement of February 1878, the land was harrowed and ridged in drills 2½ feet apart. The field being narrow, cross ridging could not be done with the plough and the hills were formed by hand-labor 2 feet apart.

Preparation of the land.

67. The nursery for raising the seedlings was made at the southern end of the field at a place which had been previously filled and therefore did not require much preparation. The ground was dug over to a depth of 1½ feet during the month of Novembr and a second time at the commencement of December; horse manure was applied at the rate of a country cart-load per 100 square feet; and a drain was dug round the nursery in order to provide adequate drainage. The whole was covered with a roof of palmyrah leaves supported on poles.

Management of the nursery.

68. Some Lanka tobacco-seed was received from the Kistna District and a sample of seed was also received from Madura. Professor I. Giglioli, M.R.A.C., of the Royal High School of Agriculture at Portici, had the kindness to send, amongst other seeds, several varieties of tobacco-seed. Three nursery beds were sown on the 3rd of January as follows:—

Varieties sown.

1 bed with Paravaram	Lanka	seed.
1 bed with Gopalapuram	do.	do.
1 bed with Madura	do.	do.

And some days later duplicate beds. Each division measured 8 feet in length and 3 feet in breadth. The seeds obtained from Italy were sown in another nursery in the Botanical Garden close by at the same time. The soil having been reduced to a fine tilth, the seed was sown broadcast and covered with some fine compost manure.

The seed germinated very well and the plants of the first sown seed appeared above ground on the 12th of January, 9 days after sowing. As the plants stood thickly they were thinned out about 14 days after their appearance above ground; they were watered frequently during the first and the second week but received less water afterwards. The plants grew luxuriantly and had put out 4 to 6 leaves and were ready for transplanting by the middle of February.

Treatment in the nursery.

69. The soil being very poor in organic matter, to improve its physical qualities, before planting two handfuls of well rotted manure were put in each *hill* and mixed with the top soil. The transplanting of the seedlings commenced on the 13th of February and continued for some weeks, only one man being employed for about 1 hour after 5 P.M. The field was divided into 3 equal plots. Two plots were planted with seedlings raised from Lanka seed and the other plot with plants raised from the Madura and Italian varieties, the last-named plants, however, occupied only a few rows. The plants after being

Method of planting out.

planted were watered at once and shaded with palmyrah leaves during the first few days; they were watered daily for about four days and afterwards at greater intervals. Although it was very hot at the time, nearly all the plants took root, the few that died being replaced from the nursery.

After cultivation and treatment.

70. The land was hoed twice, the soil being heaped up around the plants each time. Saltpetre was applied when the plants were about one foot high. The saltpetre was applied in a dissolved state at the rate of one cubic inch per plant, or about 200 lb. per acre. The flower-buds appeared about two months after planting and were broken off at once; and with them the bottom and some of the top leaves, only 7–8 being left at first but, on finding that more leaves could be left without detriment to the plants, 10–14 were left afterwards. (Subsequently in the Botanical Garden some small plots of tobacco of the same varieties were raised, when as many as 24 leaves were left, which all grew to a large size.) At the time of topping several varieties of grass-hoppers attacked the tobacco leaves; and some persons were employed for several hours every morning to kill them. The suckers, which appeared in the axils of the leaves, after topping the plants were broken off once in every four or five days. Water was applied once in every 4–8 days according to the state of the weather.

71. Of the plants raised from the seed received from Italy, only a variety of the *Macrophylla* species succeeded; it grew luxuriantly to a very great height, and the leaves were very large, thin, and appeared to be of fine quality. The plants raised from Madura seed belong apparently to the Virginian species (*Nicotiana augustifolia*); the leaves are very long, some as much as $2\frac{3}{4}$ feet, but much pointed. The Lanka tobacco produced very large leaves, which warped very much and became very gummy, thick, and coarse.

72. In spite of their being planted $2\frac{1}{2}$ feet apart, the plants spread so much that there was no room to walk between the lines, especially in those parts of the field that had been filled when the field was levelled. The consequence was that many leaves were torn and rendered valueless. During the latter part of the growth several showers of rain, followed immediately by sunshine, caused rusty spots on the leaves.

Ripening and harvest.

73. About three months after transplanting the plants began to ripen, and the harvest was commenced at the end of May. After cutting, the plants were immediately placed under the shade of a large mango tree standing close by. Bamboos had been previously cut in lengths of $4\frac{1}{2}$ feet and on each bamboo eight of the large or twelve of the small plants were hung. A framework had also been erected, on which the bamboos with the plants were so placed as not to allow the latter to touch the ground. After the plants had hung in this manner for a day they were sufficiently wiltered to be removed to the drying-shed.

Management of leaves in the drying-shed.

74. This shed was furnished with bamboo frames in two tiers; the first 4 feet and the second 8 feet above ground. The tobacco on being brought to the shed was hung close together on the lower tier, and, after six or eight days, having gone through a slow fermentation and turned to a light yellow color, was hung on the upper tier further apart to arrest rapid and injurious fermentation. The shutters, which were kept closed during the first week, were opened afterwards unless the wind was very dry. After the second week the plants were again hung more closely; those that were placed originally on two or three being hung on one bamboo. They remained thus until stripped, being examined occasionally in the interval. They were fit for stripping, that is, the midribs were thoroughly dried, about twenty days after the tobacco had been brought to the shed. The air being at that time exceedingly dry the leaves could not be stripped at once on account of their brittleness; it was necessary to wait for a shower of rain to moisten the air; one fell soon afterwards, and the leaves became sufficiently soft and pliant to be easily handled.

Stripping.

75. An experiment was made to bulk part of the tobacco ten days after it had been brought to the shed. For this purpose a floor was made of some planks covered with straw and on this the tobacco was laid, tied in bundles of ten plants each; between the layers some straw was put. The heaps were about 5 feet square and 3½ feet high. The first day the temperature in the centre of the heap reached 95° and the leaves appeared improved, but on the second day it had risen to 105°, and the heap was rebulked; it however heated again rapidly, and the next day it was found that the tobacco had sweated very much, and, on opening some bundles, it was discovered that some stems had commenced to rot. The tobacco was then again hung on the frames and kept there for some days and afterwards was bulked again, but after about eighteen hours, when the heap was reopened, it was seen that the thick stems had again commenced to rot, this time also affecting part of the leaves. Some other tobacco, which was not kept so long in bulk at one time, did not rot as much, but in this case also the results were not satisfactory, most of the leaves turning dark-brown and losing more or less of their elasticity.

Experiment in bulking.

76. Some other tobacco was put into a heap in the evening of the second day after cutting; the whole, about 100 plants, occupied only three courses; it was lightly covered with straw and some planks. When examined the next day, it was found that the tobacco had sweated much, and the temperature had risen to 115°. Some of the leaves, especially those in the centre, had turned brown. This tobacco was evidently bulked in too green a state, and could not withstand the great heat.

Further experiments.

The same evening some other tobacco, about 200 plants, that had been cut four days previously and contained less sap was put into a heap; the plants being left, in this case, on the bamboos. The heap was about twice as large as in the foregoing experiment, but less compact, the bamboos causing many empty spaces which facilitated the circulation of air in the heap. This heap was examined, with the heap mentioned before, the next morning, and it had only commenced to sweat and the temperature had risen to 110°; and the leaves had attained a light yellow color. The tobacco of both heaps was rehung and treated like the rest, there being insufficient room to carry out separate experiments.

It is probable that by bulking tobacco in small heaps for a short time in such a way that the moisture can escape and so prevent strong sweating, as done in the last experiment, the color of the tobacco may be fixed in a short time and some days may be gained in drying the leaves; most probably tobacco would attain a more uniform color when treated in this way than otherwise.

77. At the end of June the leaves, having absorbed some moisture from the air and become pliant, were stripped. At the commencement of July the air contained so much moisture that the tobacco commenced to turn mouldy; it was then exposed to the sun for a few days and the mould brushed off. When stripping four classes of leaf were made, but it was difficult to make the men who stripped understand how to classify properly. The whole outturn was over 1,000 lb. of dry leaf, not including the suckers and bottom leaves removed from the plants on the field. The percentage of first-class leaves was small on account of the tearing of many leaves in the field by the coolies who had no experience, and on account of the bulking experiments which yielded only third-class leaves. The tobacco after stripping was put into a heap, where it heated slightly and was rebulked after ten days and again one month later, after which time heating was scarcely perceptible.

Outturn.

In this experiment the Lanka tobacco was found to produce heavily, but the leaves were thick and coarse. The Madura tobacco yielded heavily and also produced a fine leaf. The most successful however was the Maryland (*Macrophylla*) tobacco, which yielded the largest return and the finest leaf.

General results.

78. Some seed of the above-mentioned varieties, as also of the Kentucky variety, was sown on the 1st of May 1878 for a further experiment. The nursery bed was made in the same place in which the plants for the previous experiment

had been raised. The seeds germinated well, and the plants were planted out on the 20th of June; they were treated in the nursery bed and after transplanting just as in the previous experiment; they grew very well, but it was observed that those of the Lanka variety did not grow so high as in the former experiment and that the leaves also were not so large. The plants of the three other varieties attained a height of from 5 to 8 feet and developed from six to twenty-four large sized leaves. The tobacco was cut at the commencement of October and was cured in the same manner as described above with very good results; the leaves assumed a golden color, this was gained by simply hanging the plants on sticks closely so as to prevent rapid drying.

Another experiment.

79. *No.* 29.—Several varieties of tobacco seed having been received from America another experiment in tobacco cultivation was instituted to ascertain the comparative value of each. The seed was sown on the 12th October 1878 in the place where the plants for the former experiments had been raised. The following were the varieties of seed sown:—

Maryland; raised on the Farm.		
Kentucky;	do.	do.
Madura;	do.	do.
Do. ; received from Madura.		
Trichinopoly;	do.	Trichinopoly.
Virginian;	do.	America.
White-stem;	do.	do.
Havanna;	do.	do.
Lanka; raised on the Farm.		

Growth and treatment in the nursery.

The plants appeared above ground about eight days after sowing the seed, and were planted in open beds on the 10th November 1878. Although the sun was very powerful at that time nearly all the plants took root, water being applied twice daily for a few days after transplanting. They remained in the second nursery bed until the middle of December, when they were planted in the field. Part of the same plot used for the experiment of 1878 being again used; the land being prepared in the same way as previously. The seedlings were planted in holes made on hills, about 5 square feet being allotted to each plant; and cloudy weather having been utilized for planting very few of them died. The plants raised from Farm seed, except those of the Lanka variety, took root easily and grew rapidly, as well as the plants raised from seed received from Trichinopoly; but those raised from seed received from America never grew properly and the plants attained only a small size; those raised from Lanka seed did not thrive well and the height attained was only about 2 feet. All the varieties were similarly treated as to preparation of soil, manuring, watering, &c. The plants were watered by means of watering pots for the first few days after transplanting, and received only four waterings afterwards, the heavy dews occurring during the whole time of their growth rendering more frequent irrigation unnecessary; and it is possible that watering might have been entirely dispensed with without impeding the vigorous growth of the plants. The land was only hoed once, most of the plants growing so vigorously and spreading so much that it was difficult to walk through the lines without breaking the leaves; a second hoeing was also unnecessary because only a few waterings were applied so that the soil remained friable, and the early spreading of the leaves checked the growth of weeds.

Acclimatized seed succeeded best.

After-treatment of land and crop.

80. The three varieties mentioned first grew on land that was used for the first tobacco experiment, and the plants of these varieties were the most vigorous and healthy of all; this is undoubtedly partly the result of the plants having been raised from seed grown on the Farm; but this cannot be the sole cause, and it is well known that, when tobacco is consecutively grown on the same field, the crop grown in the second year often yields more heavily. This is easily explicable; for the first crop the soil, if not extraordinarily rich, is generally heavily manured, so that, if a special manure has been applied to supply the potash and lime needed,

the soil, after its growth must be in a better manurial condition than before: if the land be again heavily manured for the second crop that crop should have more chance of succeeding than the first; the mechanical treatment of the soil before and during the growth of the first year's crop must considerably improve the physical properties of the soil and has undoubtedly an important effect in this respect.

81. Saltpetre was applied at the rate of 200 lb. per acre; it was applied in a dissolved state and directly to the plants. By mistake common salt at the same rate was applied to the two first varieties instead of saltpetre. This may have caused the plants to grow more vigorously than those in some of the other plots, it being well known that tobacco manured with common salt generally yields heavily, but produces a coarse leaf. About two months after planting, the flower-buds appeared, and were broken off with some of the upper leaves, from twelve to twenty leaves being left according to the size of the plants. The plants of the first, second and third experimental plots arrived at maturity about the end of February when they were harvested. The Virginia, the White-stem, the Havanna, and the tobacco raised from Trichinopoly seed required apparently fully a month more to attain maturity, but were cut down when the tobacco in the first experimental plots was harvested on account of an insect attack.

Ill-effects of common salt as a manure.

82. The tobacco grown in the first four experimental plots was cured in the same way as in the previous year. During this experiment the plants however required about a month's drying before being fit for stripping, because the tobacco was harvested at a time when there was more moisture in the atmosphere than during the first curing experiment. The stripping was only commenced at the end of March and the outturn of leaves cannot be ascertained at present. It is believed that some plots yielded at the rate of 1,800 lb. per acre. The tobacco of the remaining experimental plots was cured according to the mode often adopted by ryots in this country:—The leaves were stripped in the field and put into heaps; two days after the heap was rebulked and again left for two days, after which time it was opened and was found to be much heated, some of the leaves had become brown, others only yellow, and others still remaining green; the tobacco was then hung up on a scaffold and dried to arrest decomposition. The tobacco remained on the scaffold for two days, after which time it was again put into heaps; when it had become heated it was again rebulked; this process was continued for about a week more, after which time most of the tobacco had dried and assumed a brown color and emitted a rather sharp pungent smell, which was considered by some Natives to be a sign of good tobacco. Curing according to this fashion involves much labor, but though the tobacco obtained may find a market in the Native bazaar for ordinary consumption, it would certainly not be appreciated by Europeans. Another drawback resulting from this mode of curing is that the tobacco must be worked over so often that it is nearly impossible to get an unfractured and smooth leaf well adapted for cigar manufacture.

Curing of the crop.

83. The last experiments in tobacco cultivation tend to corroborate the conclusions drawn from the results of the first experiment, that under proper cultivation the soil and the climate met with here admit not only of raising a fine tobacco but also a tobacco that yields heavily. The results of the last experiment also show that when tobacco is grown during the cold season irrigation may be entirely dispensed with, thereby not only reducing the cost of cultivation but enhancing the outturn, because the soil remains more open and friable and produces a finer tobacco than when the soil has assumed a close texture from frequent irrigation.

Conclusions drawn.

84. The *Macrophylla* species has now been raised three times on this Farm during the past year at different seasons, and has always succeeded, showing thereby that it is well adapted for the conditions met with, and as it yields a good tobacco and produces heavily it should be extensively cultivated. The same must be said of Kentucky tobacco, which has now been grown twice, once during the cold and once during the

Varieties which have succeeded.

hot season. Next to these two varieties comes the tobacco raised from Madura seed. As regards the suitability of the Havanna, White-stem, and Virginian varieties, the non-success of the first attempt cannot decide the question ; some more experiments will be necessary. The Trichinopoly tobacco (a Virginian variety) succeeded tolerably well, but as the leaves are very narrow and therefore not well adapted for covering leaves for cigars, this variety does not deserve much attention.

Raising seed.

85. Tobacco seed has been raised of all the varieties above referred to. The seed was ripe about two weeks after the leaf had matured. The plants that were allowed to run to seed were cut down immediately above the surface when most of the seed capsules had assumed a brown color ; they were then tied in bundles of 8–10 plants each and hung up in a room head downwards ; by this means the seed that was not fully matured ripened completely. After two or three weeks, when the stems of the plants had become completely dry the seed was threshed out and dried ; seven large plants of the Kentucky variety yielded 14 ounces of tobacco seed, which would be sufficient to raise plants for 14 acres. The *Macrophylla* and Madura varieties raised on this Farm will yield an equal amount of seed, but the plants of the other varieties much less as the plants are much smaller and produce only a small sized panicle.

Second growth of leaves.

86. Soon after the plants had been cut down, new shoots issued from the remaining stalks, which grew very vigorously and attained a height varying from 2 to 3 feet in the first plots ; the new shoots of the *Macrophylla* tobacco are the most vigorous ; generally two shoots have been left, the number of leaves on the plants are between twenty and forty, but they are much smaller than those of the first growth. After cutting the first crop the land was once ploughed between the lines and received one watering. No further hoeing or watering will be required to mature the second crop.

87. During the year the total extent of cultivable land was 145·94 acres. The following areas of crop were raised :—

			ACRES.
First crop harvested before	April 1st	... ...	102·13
Do. standing on	do.	... ...	24·87
Second crop standing on	do.	... ...	43·48
Do. harvested before	do.	... ...	44·06

So that a total area of 214·54 acres of crop were raised ; of these, some were grazed down by live stock and it has not been possible to record the outturns. The number of pairs of cattle maintained to perform the cultivation of the land referred to was 15½ pairs, but they were employed on this work only during part of their time, as they also performed a considerable amount of work for the estate.

SECTION III.

MANURES.

88. *Manuring Experiments.*—The great alterations made with nearly all the fields on the Farm during the last few years prevent in some measure the satisfactory making of manuring experiments ; the results of the experiments of the past year show clearly that our soils are as yet scarcely sufficiently uniform for the purpose.

89. *Top-dressing Sugar-cane.*—The soil of the field in which the experiments, the results of which are recorded below, were made, is of a stiff and adhesive character, its nature not being due to the presence of clay but to its physical state.

Preparation of the land.

The land was prepared for planting by scarifying and harrowing it twice, and ploughing and subsoiling it to the depth of about 1 foot; it was then rolled and trenches were made with the plough about 4 feet apart, which were deepened subsequently by hand labor. The whole field was manured with blood-manure before planting at the rate of 12 tons per acre. Two varieties of sugar-cane were planted, a white variety and a red variety; the shoots of both were obtained from Bangalore. The sets were placed in the trenches about 1 foot apart and were covered with a little soil; this was done at the end of January 1878 and the field was constantly watered for some days after. When the shoots were about 1½ feet high saltpetre was applied, to plots each $\frac{1}{30}$th acre in area, at the rates mentioned in the following table :—

	Top-dressing applied per Acre.		Outturn.				
	Quantity.	Description.	Number of Canes.	Weight of Canes.	Weight of Straw.	Total Weight.	Total per Acre.
	LB.		LB.	LB.	LB.	LB.	LB.
White Cane.	112½	Saltpetre ...	146	188	2	190	5,700
	225	Do.	172·5	402·5	94	496·5	14,895
	337½	Do.	380	856	224	1,080	32,400
	450	Do.	215	463	94	557	16,710
	...	None	381·5	781	192	973	29,190
Red Cane.	337½	Saltpetre ...	71	78·5	120	198·5	5,955
	450	Do.	265	315	364	679	20,320
	...	None	225	224	250·5	474·5	14,235
	112½	Saltpetre ...	125	119	224	343	10,290
	225	Do.	225	244·5	224	488·5	14,655

After-treatment of the crop.

90. During the growth of the crop it was hoed five times and was watered whenever necessary; as this water had to be raised a considerable height by bullock labor, the expenses under the heading were very great. At the end of July, 15 tons of horse manure per acre were applied to the crop with a view to accelerating its growth. Owing to the attacks of white-ants from the very commencement the crop was very patchy, and about the middle of December, some time before the canes had fully matured, it was so severely attacked by rust as to necessitate its being cut down, so that the results obtained must be received with caution; neither the soil nor the other conditions of growth being favorable. The results given are the averages of two plots of white and red cane respectively, the results which stand first on the table being those obtained with the white cane. As the great variations show, the value of these results is small; they appear, however, to show that saltpetre is of doubtful value for this crop on such land.

91. *Manuring Cotton.*—A series of experiments were commenced during the year with a view to duplicate the results obtained in 1872 with the crop. The same value of top-dressings was applied, but owing to the failure of the maize crop, they were unable to exert their full effect. At the same time an attempt was made to determine the most economical amount of box manure to apply to the land. The field on which this crop was produced was levelled early in 1878; the land was stripped of its surface in some places to more than 1 foot in depth and in other places the surface was raised more than half a yard to give the field a suitable slope for irrigation and drainage purposes; it was then allowed to lie fallow, and was deeply cultivated several times to hasten amelioration of the soil. The soil is a sandy loam, open and friable. When the land was ready about the end of August it was ridged up by means of the ordinary iron plough in ridges about 20 inches apart; the box manure was then carted on and spread between the ridges, which were split over the manure to cover it. Before covering up the box manure, the substances mentioned below were applied to duplicate plots, each measuring $\frac{1}{10}$th acre, at the rates mentioned; the value of the special manure in each case was

Preparation of the land.

Manures applied.

Rupees 18 per acre. After the manure had been covered, the ridges were sown alternately with maize and cotton. The following are the manures used and the amounts applied :—

—	Plots 3 and 12.	Plots 1 and 10.	Plots 2 and 11.	Plots 4 and 13.	Plots 5 and 14.	Plots 6 and 15.	Plots 7 and 16.	Plots 8 and 17.
	TONS.	TONS.	TONS.	TONS.	TONS.	TONS.	TONS.	TONS.
Box manure	4	8	12	8	8	8	8	8
Saltpetre	...	...	...	440 lb.	...	...	...	...
Bone charcoal ...	...	...	...	...	1,080 lb.	...	...	...
Slaked lime	...	...	...	...	...	4,800 lb.	...	...
Castor-oil cake ...	...	...	...	...	...	...	1,665 lb.	...
Gypsum	...	...	...	...	...	...	...	3,150 lb.

91. The cotton seed germinated very well, and the plants appeared evenly over the whole field. They grew very vigorously and the whole crop is, as regards uniformity and vigor of growth, one of the best ever produced on the Farm. The land is also remarkably clean and free from weeds. The plants only commenced to bear at the end of January: the lint of the first gatherings was of very fine quality. The outturn up to the end of March was very good. The results of the crop and of the experiments will be given fully next year.

SECTION IV.

LIVE-STOCK.

92. *Stock-breeding Experiment.*—The Commissariat slaughter-houses, the cause of great nuisance to the Farm complained of every year, have not been removed as yet, and consequently the stock-breeding experiment has again been delayed. It is however hoped that these yards will at length be removed during the early part of the present year. A great amount of trespass is due to their presence on the Farm. On killing days the slaughter-yards are visited by a great number of people from Saidapet and other villages for the purpose of purchasing and removing offal. Many of these do not leave the yards till after dark, which makes it impossible to check entirely the trespass. The pilfering of our crops is chiefly due to the great crowd of people passing through the Farm on their way to or from the slaughter-houses. The sheep, when being driven to the yards to be killed, destroy many fine trees planted on the sides of the road. The number of people visiting the slaughter-house was—

Large amount of trespass due to the presence of slaughter-yards.

On killing days about	129
On other days about	38

93. *Australian Cows.*—To make a start in breeding cattle for dairy purposes, in December 1878 two cows were purchased which had been brought from Australia. The cows had calved shortly before they were shipped, and were about 6 years old. It was stated that they yielded daily about 9 measures of milk each when on the voyage. One of the cows resembled to a certain extent the animals of the Short-horn breed, and the other slightly those of the Devon breed. Both cows were of large size but in rather low condition when purchased; otherwise they looked quite healthy. Rupees 200 was paid for each cow, not a high price considering their age and good milk-producing capabilities. At first the cows would not take any food except bran, but they were gradually accustomed to oil-cake and green fodder. Their ration of food was at first of 3 lb. of bran. After

Description.

Food given.

some days 1 lb. of oil-cake was mixed with the bran. The ration was gradually increased to 6 lb. of bran and 3 lb. of oil-cake per day. They were fed twice daily; in the morning at 6-30 and in the evening at 4-30 ; at which times they were also milked. They received about 50 lb. of green fodder per head a day; they were also allowed to graze every morning from 8 until 9. They only yielded a little milk for the first few days, but more, in proportion, as their appetite improved. Both the cows greatly increased in weight after they became accustomed to the food, and were very fine-looking animals and full of vigor at the commencement of February.

94. However, both died suddenly on the 7th February last. They exhibited no symptoms of sickness until the 6th evening, when one of the cows, called Shorthorn, gave no milk and refused her food; her eyes appeared watery and she had some light purging. The next morning this cow voided blood, bad saliva passing from her mouth, her horns were cold and her coat appeared rough. The symptoms of sickness became worse as the day advanced and the cow died at 3 P.M.

Sudden illness.

The second cow, called Devon, appeared quite well up to the 7th morning, at which time however she did not give a full yield of milk. She seemed quite well at 10 A.M.; at 11 A.M. however she had an attack of convulsive fits which increased rapidly in severity and the cow expired at 2 P.M., immediately after Veterinary Surgeon Western had left.

95. The following is a copy of the report of Veterinary Surgeon Western regarding the sickness and death of the two cows:—

"I have the honor, in compliance with your request, to inform you that as a result of my investigation into the matter of the death of the two Australian cows on the 7th February 1879, I am of opinion that the cause thereof was the disease called "Anthrax," in that particular form commonly known in England as "Splenic feres." The fact of these two only of the Farm cattle being so simultaneously attacked induced a belief that something injurious in their food, or possibly intentional poisoning might have been the origin of their illness; but the *post-mortem* appearances entirely set aside such suspicion. The black, tarry fluid condition of the blood, the enlargement of the spleen, the bloody fluid in the abdominal and thoracic cavities with the extravasations of blood about the roots of the large blood-vessels and beneath the lining membrane of the ventricles of the heart and other changes found alike in both carcasses, were peculiarly characteristic of anthracoid disease. More animals die in this country from maladies of this class than of any other disease, rinderpest perhaps alone excepted. It is supposed to be of miasmatic origin, and organic matters undergoing decomposition under the influences of humidity and a high temperature, are said to furnish the germs which give rise to it. These, if recent researches into the nature of the disease are to be relied on, would seem to be organisms called bacteria, which, acting as a ferneous in the blood, bring about in it such changes as render it unfit for the nutrition of the tissues; and, by arresting the function of the more important organs, rapidly produce disorganisation of the whole system and consequent death of the animal. Damaged forage, as that which is mouldy or affected with fungi, or water of a brackish, marshy or putrid character and charged with organic matter, have been blamed as aiding in the production of anthrax; while a condition of the animal, consisting in the loading of the system with waste organic matters, is said to be brought about by overfeeding and plethora in such as make flesh most rapidly, in the young and rapidly-growing, but especially in those quickly recovering condition after previous emaciation, which is thought to predispose to the reception of the poison and development of the disease. It is found to be most prevalent in marshy districts where water stagnates, or on the banks of rivers where pastures are liable to be submerged, and the injurious effects of these conditions are increased when the soil contains sulphates or other saline matters which favor the decomposition of organic substances. Principal Veterinary Surgeon F. F. Collins speaking with regard to equine anthrax (Loodiana disease) writes in a recent number of the Veterinary Journal: "I have found by the annual reports received from Veterinary Surgeons that the nature of the soil at all stations where malignant fever shows itself is identical, *viz.*, alluvial with a clayey subsoil;" lastly anthrax is propagated by contagion. The isolated condition of the two cows on the Farm almost precludes the possibility of their having been in contact with diseased cattle unless through the medium of manure brought from the slaughter-house; their food the same as that used for all the other cattle on the Farm was cake bran and green cholum; this latter was rusty, *i.e.*, affected with fungi, and although these cows only were sufferers, that fact does not render it impossible that this case may have had something to do with their illness, because it is well known that animals will often thrive on food to which they are accustomed, although on others not habituated to its use it may act as virulent poison. The shed in which they were kept is

on low ground near the banks of the river an alluvial sand; it has, I am told, for years been used as a cow-shed, and the soil underlying those occupied by all the Farm cattle is the same alluvial bed. The river is at present low and much of the usually submerged soil is now exposed to the drying effects of the sun. The river-flats have recently been undergoing "puddling" for paddy, and the flood-water was lying in all the hollows near. The water is charged with sulphuretted hydrogen and all kinds of bad-smelling organic matter. The cows very probably drank some of this water and may have eaten of the grass growing on the river banks, and although I learn that sheep now graze on the banks with impunity, experience has proved that at certain seasons fatal disease occurs amongst those permitted to do so, and it is well known that animals may become inured by residence in a malarious district and less apt to suffer from its injurious effects than new-comers. The cows were not only new-comers, but had recently undergone the ordeal of a confinement on boardship, calculated of all other conditions to bring about the condition of system I have referred to as predisposing to the disease, a condition likely to have been aggravated by exposure to a hot sun and close muggy weather to which they were unaccustomed. Their food on the voyage was probably only bran and chaff, and the change though their food at the Farm could not be considered high living, was at any rate to food more nutritious than they had recently received. Although then I am unable to point to the precise cause in operation for the production of the disease in these cows, and although, as I have shown, the other cattle of the Farm were subjected to similar conditions, it must, I think, be admitted that some at least of the ordinary conditions known to favor the development of anthracoid disease were in existence. This unfortunate termination of an experiment to acclimatize imported cattle need not, I think, discourage future attempts in the same direction, inasmuch as the conditions above referred to as probably causing the disease may in great measure be avoided. Referring to the suspicion of poisoning, I would suggest that a few experiments on the action of vegetable poison which are alleged to be in common use for the criminal destruction of animals might with advantage be made with a view to the recognition of the symptoms and *post-mortem* appearances by which such poisoning may be recognised. A small sum would suffice for the purchase of a few otherwise worthless animals as subjects for such experiments, and the information to be gained would, I think, be valuable in assisting in the suppression of such crime if it really be practised. I am however inclined to the opinion that statements as to the use of vegetable poisons have been published on very loose and unsatisfactory evidence."

96. Suspicions having been entertained at that time that the death of the cows was caused by poison, the stomach with its contents was forwarded to Mr. W. Hamilton, Assistant Professor at the Medical College and Lecturer in the Agricultural College, with a request to analyse the contents of the stomach with the view to ascertain whether it contained any poison. The following is a copy of the letter received from Mr. Hamilton regarding the matter :—

"With reference to your letter of the 8th instant, No. 431, I have the honor to inform you that I received the viscera and contents sent therewith. The absence of mineral poison having been proved, an alcoholic extract, prepared from the contents of the stomach and small intestines, was eaten by a small dog without any injurious consequences following."

97. The following table shows the yield of the milk of the two cows from the date of their arrival on the Farm until the date of their death :—

Month.	Quantity of Milk.		Value.		
	MRS.	OLKS.	RS.	A.	P.
December 1878 ...	283	3¼	47	3	9
January 1879 ...	314	5	52	7	0
February „ ...	58	5	9	12	4
Total ...	656	5¼	109	7	1

98. The cost of feeding the cows during the time was as below :—

	RS.	A.	P.
146 lb. ground-nut cake	2	14	9
916 lb. bran	18	5	1
6,800 lb. green food	22	10	8
Cost of attendance and sundries	9	0	0
Total ...	52	14	6

The figures show a net income of Rs. 56-8-7 during the ten weeks that the cows lived. The result shows how very valuable a property good dairy cows are, and were it not for the greater risk attending the breeding of English cows than those of indigenous breeds, the shortest way to the improvement of Indian dairy stock would be to import cows from Australia. Under any circumstances it will be advisable to import some bulls of good breeds for crossing on the native stock.

Value of good dairy cows.

99. *Aden Cow.*—This cow, referred to in paragraph 99 of the last year's report, continues to give most satisfactory results. She calved in June last, or about a month before she was due, and consequently the cow was in bad health for some time after. The calf also was very delicate for some time; it was a heifer, all the previous ones having been bulls; this is fortunate, as it will be available for carrying on the breed, especially as the cow shows signs of approaching old age. The cow is expected to calve again in July next.

The following table shows the yield of milk from this cow from the middle of July 1878 until 31st March 1879; up to the middle of July all the milk was given to the calf.

—	Yield of Milk.		Value.		
	MRS.	OLKS.	RS.	A.	P.
July (15 days)	24	0	4	0	0
August	55	6	9	4	8
September	75	0	12	8	0
October	77	4	12	14	8
November	75	4	12	9	4
December	76	3	12	11	8
January	81	5	13	9	8
February	71	2½	11	14	2
March	73	1	12	3	0
Total ...	610	1½	101	11	2

The cost of producing this milk was as follows:—

	RS.	A.	P.
500 lb. of ground-nut cake	10	0	0
560 lb. of bran	11	3	2
8,520 lb. of green food	28	6	5
Cost of attendance and sundries	9	8	0
Total ...	59	1	7

So that in this case the milk cost 1 anna 7 pies per measure. The cow, it will be seen, gave a net profit during the milking time of Rupees 42-9-7 besides bringing up her calf.

100. *Nellore Cow.*—A cow of the Nellore breed was also purchased during the year. This cow was bought chiefly with the view of using it in carts, so as to demonstrate the value of cows as draught animals. She was easily trained in a single cart and was generally used in light work, such as carting green fodder from the field, &c. She was used until about two weeks before she calved. The calf—a heifer—was well developed when born and does not appear to have suffered in any way from the work her mother had to perform until close to its birth. The daily yield of milk up to end of the year was about 2½ measures; the cow also rearing her calf. It will be a great boon to this country when the ryots can be induced to look upon their cows as draught animals and to use them as such. In some parts of Germany the small farmers use nothing but cows for the performance of agricultural operations, and even the large landholders frequently use them for light work. Arrangements are generally made that the cows may calve at a time when little or no farm work can be performed, so that the yield of milk after calving, when they have no work to perform, is unaffected,

Worked regularly.

Value of cows for draught purposes.

and when they are put to work every day for half a day some months afterwards the yield decreases only slightly. It is considered generally that cows that are put to light work are more healthy than those kept always in the byre. During forty-six days after calving this cow yielded 114 measures 1½ ollocks of milk, worth Rupees 19-0-6; the cost of maintaining her during the same time having been Rupees 12-2-2; the milk in this case was produced at 1 anna 8 pies per measure.

Cost of milk.

101. *Sheep.*—The improvement of the flock is proceeding steadily but slowly. If animals of a better breed are not used for replacing or crossing the Farm breed of sheep, it will require many years more to bring the wool of the flock to such a degree of perfection that it will command a price more in proportion to the value of the food consumed to produce it than is at present realizable. As the production of a pound of coarse wool requires the consumption of nearly the same amount of food as one of fine, it is very desirable to improve the wool of the flock in the shortest time possible to such an extent as to make it find a ready market and fit to compete with the fine wools of other countries in the European market. At present great difficulty is experienced in finding a market for the wool in this country at a fair price. In order to hasten the improvement of the sheep more rapidly than can be possible under the present arrangements, the advisability of importing some sheep of the Merino breed from Australia should be considered; sheep of that breed generally stand a dry hot climate very well.

A wool saleable in European market required.

The death-rate of the sheep on the Farm was high during the year, it being as much as 13·14 per cent. The following table gives the figures relating to the subject for the past six years:—

—	1873-74.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79.
Average number of flocks	207	221	237	275	295	274
Number of deaths	16	24	21	11	31	34
Percentage of deaths	7·73	10·9	8·9	4	10·5	13·14
Rainfall in inches	48·07	68·98	38·14	20·88	65·55	33·16

Most of the sheep died suddenly, death being caused, it is believed, generally by heat apoplexy; but this year again a number of rams died from injuries received when fighting with one another.

102. The following table is a continuation of that given in the reports of the last two years regarding the wool-production and size of our sheep:—

—	1877.			1878.			1879.		
	Number.	Average Weight.	Yield of Wool.	Number.	Average Weight.	Yield of Wool.	Number.	Average Weight.	Yield of Wool.
Rams.		LB.	LB.		LB.	LB.		LB.	LB.
Lambs	38	28	Not shorn.	28	38·6	Not shorn.	...	...	Not shorn.
Shearlings	31	47	1·76	...	52·6	...	18	47·2	1·55
2 shear	16	66	2·28	...	...	...	25	66·5	1·56
Other ages	23	69·5	1·94	...	73	...	30	81·5	1·66
Average	70	58·74	1·94	80	66·2	1·57	73	67·9	1·60
Ewes.									
Lambs	27	25·6	Not shorn.	31	31	Not shorn.	...	...	Not shorn.
Shearlings	34	39·6	1·6	35	45·6	1·8	26	43·8	1·42
2 shear	23	48	1·77	...	...	...	36	57·3	1·63
Other ages	84	53·17	1·31	101	54·5	1·6	83	61·1	1·63
Average	141	49·05	1·45	136	52·2	1·65	145	57·0	1·59
Average of sheep of all ages.	211	52·27	1·62	216	57·4	1·62	218	60·6	1·59

The figures show that, although there has been a marked increase in the average live weight of the sheep, the yield of wool was slightly less this year; the chief decrease being in the case of the young sheep.

103. *Pigs.*—On the 23rd October, two boars and one sow with four sucklings were purchased. The price paid for them was Rupees 85; a very moderate sum. The pigs are not first-rate, but are of fair size and apparently of quick growth. The young ones, which when purchased were about six weeks old, grew well, and will be fit for breeding purposes when about nine or ten months old. The weight of the pigs on the 9th April was as follows:—

	LB.	
1 old boar	309	about $2\frac{1}{2}$ years old.
1 „ sow	282	
1 large young boar	151	purchased as sucking pigs; age 7 months.
1 small do.	112	
1 large young sow	122	
1 small do.	91	

The following table shows the food consumed by the pigs up to the 31st of March 1879, and its cost:—

	RS.	A.	P.
1,824 lb. of ground-nut cake at Rs. 9 per candy ...	32	13	3
1,014 lb. of bran at 50 lb. per rupee	20	4	6
374 lb. of tour at 71 lb. per rupee	5	4	3
Total ...	58	6	0

The pigs were fed twice daily; in the morning at 7 and in the evening at 5 o'clock; they were confined the whole day in the styes because there is no proper accommodation for pigs at present on the Farm. When the slaughter-houses are transferred to the Farm, proper arrangements can be made for pig-stock; the styes must have free ventilation and be at the same time protected from the sun. A yard for exercise close by, shaded by some trees and supplied with a small tank, &c., should also be provided.

104. *Poultry.*—The Pekin ducks imported from China in July 1875, referred to in paragraph 50 of the annual report for the year ending 31st March 1876, died off during the past year. It will be remembered that for some time after their arrival the ducks got on very well; they appeared to enjoy perfect health and laid a great number of eggs, many of which were sent into the districts for breeding purposes; but after the first hot season their health gave way, they almost ceased to lay eggs, and several of them died. They altogether ceased laying eggs at the commencement of last year, when several of them also died within a few weeks. To prevent the entire loss of the breed arrangements were made with Mr. Bird of Ootacamund to receive two ducks and one drake from the Farm, and to give in exchange a number of ducklings of the same breed as soon as available. The birds throve very well in Ootacamund at first, but died rather suddenly some months afterwards. As the ducks did well at first it is probable that those imported were not young when received and succumbed to the effects of the climate as they grew older. As the breed is a very fine one, the importation of a further supply may be advisable.

Loss of all the original importations of Pekin ducks.

SECTION V.

FOODS AND FEEDING.

105. No feeding experiments were made on the Farm during the year; but, although it cannot be denied that for experiments in this direction there is still a large field not touched on as yet in this country, with the means available, it is not advisable to attempt such investigations. In practice it is often found that the best results are

Experiments required to determine comparative value of foods.

not always obtained from foods considered the best from a chemical point of view; on this account it is necessary to ascertain the feeding value of a substance, and this varies greatly according to the age, sex, breed, &c., of the animal fed, and with the state of the food; whether it be grown in the cold or in the dry season, whether cut at an early period or when it has attained maturity, whether fed in a green state or after being made into hay, &c.

Feeding of the cattle.

106. During the year the food principally given to the cattle was ground-nut oil-cake; 4 lb. of cake was generally allowed per head, but to this 2 lb. of grain per head was added when there was great pressure of work, as is usually the case during the sowing season. Besides this each bullock received about 30 lb. of chaff or green fodder daily. The cows were almost always supplied with green fodder, as they yield more milk when fed with it than with dry straw; as the Guinea-grass always produced some food during the dry season, there was no difficulty in doing this. Sorghum straw cut green appears to be one of the best foods we possess for cows; they not only take it readily but they generally yield more milk when fed on it than on other food. The working cattle were during the year fed entirely in the boxes; there was always a sufficient amount of fodder in the yard to make grazing in the field unnecessary. By housing the cattle during noontime more manure is obtained, and the cattle are in a better state for work when fed under shelter than when they are obliged to seek their food during the great heat of the day.

107. In the table given below the number of stock maintained on the Farm during each month of the year is given, and their equivalent as country cattle of 300 lb. live weight:—

Months.	Cattle.	Sheep.	Pigs.	Equivalent as Country Cattle.
1878.				
April	31	279	...	118
May	31	268	...	116
June	31	268	...	116
July	32	266	...	117
August	33	262	...	118
September	33	260	...	118
October	36	256	...	123
November	36	245	7	125
December	36	243	7	125
1879.				
January	38	249	7	130
February	38	282	6	135
March	37	274	6	132
Average ...	34	263	3	123

The actual cost incurred for feeding these animals with purchased food is given below :—

	RS.	A.	P.
91,142 lb. ground-nut-oil cake	1,833	0	1
2,978 lb. bran	70	0	5
22,460 lb. paddy straw	71	3	9
490 lb. salt	16	8	6
Rupees ...	1,990	12	9
Deduct one-third chargeable to manure	663	9	7
Actual cost of feeding stock equal to 123 head of country cattle	1,327	3	2

The price paid during the year for ground-nut-oil cake remained high.

108. In the following table the cost of feeding our stock during each of the past three years is shown, together with various other details of interest :—

—	1876-77.	1877-78.	1878-79.
Live stock maintained calculated as country cattle ...	132	135	123
Percentage of deaths	7·5	12	8·6
	AS. P.	AS. P.	AS. P.
Cost of purchased food a head per mensem	8 6	10 6	14 5
Stock, as country cattle, per 100 acres of cultivable land.	82·5	84·375	84·24

SECTION VI.

IMPLEMENTS AND MACHINES.

Utility of having heavy ploughs.

109. *Swedish Ploughs.*—During the extremely dry weather of the year, the utility of the ploughs imported from Sweden was repeatedly demonstrated ; by using heavy ploughs, field operations could be performed at almost any time during the year. Nearly all the fields that carried a cold weather crop were ploughed during the month of March, and, owing to the exceptional nature of the season, it has been possible to continue the work in April, so that if there should be rain in May none of the best time for sowing will be lost in breaking up the soil.

110. *American Plough.*—The light plough, imported from America some years ago, and referred to in paragraph 135 of the report for 1874-75, was in use nearly throughout the whole year ; it was worked as a swing plough. This is a useful implement for light soils ; being very light, it can easily be carried by the ploughman on his shoulders when going to and from the field.

111. *Collins' Ploughs.*—Two ploughs by these makers were sent to the Farm during the year for trial. Both were swing ploughs ; one was fitted with a revolving coulter ; the second had no coulter at all. The ploughs were tested in a field, the soil of which is a friable sandy loam, but intermingled with pieces of bricks, the place having been a tile-yard previously. The plough fitted with a coulter worked very steadily, the coulter acting as a wheel ; at first when the coulter was lowered and its edge fixed close to the share, pieces of bricks, which forced themselves between the share and coulter, not only stopped the turning of the coulter but also impeded the action of the share and increased the draught ; however, on raising the coulter a little, the plough worked very smoothly. The second plough, without a coulter, did not work satisfactorily ; the driver had great difficulty in managing it as he could not keep it steady, the plough having a great tendency to go downwards, a defect which could be remedied by fitting it with a wheel.

The following table shows the result of the trial; for the sake of comparison an English plough was tested under the same condition:—

Ploughs.	Average		Soil moved per 100 yards run.	Draught.
	Depth of furrow turned.	Width of furrow turned.		
	INCHES.	INCHES.	C. YDS.	LB.
Ransome's light iron; fitted with wheel...	7·8	11·5	6·92	358
American; with revolving coulter ...	7·8	10·3	6·20	336
American; without wheel	8·14	10·14	6·37	308

112. *Eagle Chaff-cutter.*—This chaff-cutter was imported from America four years ago, the cost, delivered at Saidapet, was Rupees 45. A chaff-cutter after this pattern is being made on the Farm, the cost of which will be about Rupees 36. This is a most useful machine, and one well adapted for ryots possessing not more than twenty head of cattle, for which it would easily prepare all the chaff required. An experiment was made to ascertain the amount of fodder that could be chaffed by it in one day, and the cost of doing it; the following is the result:—

	AS.
Cost of 1 cooly	3
Do. 1 boy	2
Do. oil, wear and tear	1
Total ...	6

The amount of fodder chaffed was 790 lb., so that the cost of chaffing was Rupee 1-1-0 per ton; a very moderate cost, and if the machine were used regularly it would soon be paid for by the saving of fodder effected in giving cut fodder to the cattle instead of uncut.

113. *Eagle Maize-sheller.*—This machine was also imported from America with the chaff-cutter. The whole machine is very simple and light and is well adapted for the use of small landholders; its price also is very moderate. The following figures show the capabilities of the machine and the cost of working it:—

	AS.
Cost of 2 boys	4
Do. oil, wear and tear	1

76,429 maize cobs were shelled in one day, which yielded 7,582 lb. of grain. The maize used was country maize, and as the machine is fitted for large cobs, the cobs had to be put through the machine twice; the figures are not so favorable as they would have been if large cobs had been used; the machine can however easily be so altered as to be fit for shelling large and small cobs.

114. *Hand seed-drill.*—A small hand drill was obtained during the year. The machine is very useful for sowing small areas in a garden as also for sowing blanks in fields. The feeder can easily be arranged to sow large as well as small seeds. It requires however some practice to work it properly, especially to deposit the seed at a proper depth; but in the hands of a careful man it would effect a great saving of time as it makes its own furrow to deposit the seed in and also covers it again, by means of some prongs attached to the machine, after the seed has been deposited.

115. *Double Mhote.*—This water-lift continues to give most favorable results. The only drawback connected with it is that the buckets and ropes have to be replaced frequently. To endeavour to remedy this defect, leather ropes and buckets, such as are in use near Ahmedabad, are now being experimented with, and if the results should be found satisfactory, all the fibre ropes and iron buckets will be substituted by leather ropes and buckets.

SECTION VII.

IMPLEMENT WORKSHOPS.

116. During the year the following implements were sold and sent to the districts named :—

Districts.	Iron Ploughs (from Sweden).	Iron Ploughs.	American Ploughs.	Ploughs.	Scythe.
Madras	...	...	1	...	...
Chingleput	2	...	2	1	...
South Arcot	...	1	...	...	...
North Arcot	...	...	1	...	...
Tanjore	...	...	1	...	...
Tinnevelly	...	...	2	...	...
Bangalore	...	...	...	...	1
Kaira	...	...	5	...	...
Total ...	2	1	12	1	1

117. The following are the accounts of the year. It will be seen that the deficiency against the shops since their commencement was slightly reduced during the year :—

Statement of Income and Expenditure for the Year ending 31st March 1879.

Income.	RS.	A.	P.	Expenditure.	RS.	A.	P.
Machines	396	14	0	Carpenters, Smiths and Filer ...	639	13	3
Materials	435	5	10	Cooly labor	227	6	0
Labor	888	10	9	Plant and Materials	797	13	1
Capital advanced	9	1	9	Interest	65	0	0
Total ...	1,730	0	4	Total ...	1,730	0	4

Balance Sheet on the 31st March 1879.

Liabilities.	RS. A. P.	RS. A. P.	Assets.	RS. A. P.	RS. A. P.
			Valuation—		
Capital advanced on 1st April 1878 ...	1,842 10 1		Buildings ...	431 0 0	
			Plant	208 4 0	
Advanced during the 12 months ending 31st March 1879.	9 1 9		Materials ...	233 15 0	
			Implements on sale.	331 8 0	
		1,851 11 10			1,204 11 0
			Outstanding bills ...	...	207 8 11
Labor due for March.	...	75 9 9	Deficiency	...	515 1 8
Total ...	...	1,927 5 7	Total ...	...	1,927 5 7

SECTION VIII.

ESTATE.

Land taken up to prevent nuisance.

118. A small piece of land, forming part of the bed of the Adyar, on the south-west boundary of the Farm, was added to the estate during the year. This land had evidently belonged previously to the Farm estate, but was not made use of on account of the poor nature of the soil and the uncertainty of getting a crop, the land being situated at a very low level and exposed to the river floods. The land not being used by the Farm, some persons took it up and, after cultivating it for several years, constituted thereby a claim to ownership. The land however became a source of great nuisance; it was used as a latrine by the many persons who came to the river for the purpose of washing clothes and removing sand, and thus rendered the neighbourhood insanitary. As the plot adjoins the site for the Agricultural College, and the house of the Superintendent, Government Farms, it was considered advisable to place it in the hands of the Department. The land has been cleared of part of the bushes with which it was covered and fenced in by a bank and aloe hedge.

Aloe fencing.

119. The part of the Farm bounded by the Roshumbaugh village had been fenced in during the last year. The fence consists of a bank raised from 3 to 4 feet above the surface of the ground according to its level; the soil required for raising the bank being obtained by excavating a drain on both sides of the bank; the top of the bank was planted with aloes. The work was done by contract; the cost of it was 1 anna a running yard, for a bank 1 yard high and 9 feet wide at the base and 2 feet at the top; the contractor supplying the aloe plants, and turfing the sides of the bank. It has been found that aloe hedges can be raised at a much less cost than corkapilly ones, as they require little attention after being planted, and when once grown up are well adapted to prevent the trespass of animals.

System of raising plants.

120. *Casuarina Plantation.*—A large number of casuarina plants have been raised during the year on the Farm. The seed was purchased at the rate of Annas 8 per pound from persons who collected it in the neighbourhood. The seed was sown in small beds, about 10 feet long and 5 feet wide; these beds were prepared just as if for sowing tobacco, and the seed was sown on the surface, and then covered slightly with some compost made of fine soil and well rotted manure, some cut-straw or refuse from the yard being spread over the beds to prevent surface crusting and to protect the seedlings from the sun. Usually about $\frac{1}{2}$ lb. of seed was sown in one bed, from which about 1,000 plants were raised. The plants appeared above ground in about two weeks after sowing; they were frequently watered at first, but when about 6 inches high only occasionally, and they were fit for planting out when about three or four months old. The cost of raising 1,000 plants fit for transplanting was about Rupees 2, which is very moderate; the usual market price of plants being Rupees 5 per thousand; this cost even could be much reduced, if plants were raised on a large scale. On the Farm about 60,000 casuarina trees were raised during the year; to raise them four coolies were employed for about four months in preparing the ground, sowing, watering, weeding, &c. To raise twice the number of trees only an additional cooly would have been required, reducing thereby the charges per thousand considerably.

Cost of plants.

System of planting out.

121. The plants were transplanted into the field on cloudy days in the month of December. The land on which casuarinas were planted was prepared as follows: After ploughing twice it was harrowed and ridged; the ridges were made as usual about 2 feet apart from

centre to centre. The seedlings were planted on alternate ridges. A boy in advance marked off the ridges with a stick at every yard length; a cooly following with a hoe made a hole from 9 to 12 inches deep at the spot marked; a boy following laid a plant in each hole, and a cooly coming behind, after having filled the holes partly with fine soil, planted the trees, and the whole were watered by women immediately after planting. In this manner each tree occupied about tw^lve square feet; the cost of planting including the first watering varied between 10 and 12 annas per thousand trees; which is certainly very low.

Castor beans sown to produce shade.

122. No manure being available at the time, the seedlings were not manured, but manure will be applied as a top-dressing. The ridges between the lines of casuarinas were sown with castor beans. Nearly all the trees planted took root, and, where some of them died, they have been replaced by fresh trees, and the whole promise to do very well. The castor beans germinated very well, but, as it was rather late when the seed was sown, the soil being very poor, and the weather unfavorable, they did not attain a great height; if the season had not been so very exceptional the castor plants would have grown large enough to afford shade for the trees and the yield of beans would have paid all the expenses for watering during the first year.

123. The casuarinas were planted more closely than in previous years; this was done partly for the sake of the shade the trees will afford each other and thereby be able to protect themselves better from the sun than when planted far apart, but chiefly to induce the trees to grow straight and upright, it having been observed that, when casuarina trees are planted far apart, instead of developing a straight stem their main stem is sometimes liable to fork and to produce many side branches, but no proper main stem, which considerably reduces the value of the tree.

Cost of planting.

124. In giving each tree 12 square feet, 3,630 trees can be planted on an acre of ground, which would involve according to the expenditure incurred in planting on this Farm an outlay for—

	RS.	A.	P.	
Preparation of the land by the plough	3	0	0	
Raising plants	7	4	0	
Planting, including first watering	2	12	0	
72 cart-loads of manure including carting and spreading.	36	0	0	
Total Rs. ...	49	0	0	per acre.

Cost of watering.

This cost for planting one acre is very moderate; but to it must be added the charges for watering, weeding, &c., for the first year, after which time the trees will require but little attention. It is difficult to estimate the exact charge for watering, as it depends on the nature of the weather; on the facility with which water can be obtained; and whether the soil is in good manurial condition, &c. Under favorable circumstances, especially when some other crop is raised between the lines of casuarinas for shading them, Rupees 20 may suffice, but, under unfavorable conditions, as much as Rupees 100 may be required for watering an acre during the first year after planting.

125. In the nursery beds besides the 60,000 casuarina trees referred to seedlings of the following trees have heen raised :—

Albizzia speciosa	Wild cassia.
Melia Indica	Nim or Margosa tree.
Acacia Arabica	Babool tree.
Bassia longifolia	Illoopei tree.
Cassia tora	Narrow-leaved cassia.
Syzygium jambolanum	Blue plum.

None of these trees have been planted out as yet as the plants are very young and consequently small and the weather unfavorable for planting.

126. A large number of corkapilly (*Inga dulcis*) seedlings were also raised in the nursery. The ground was dug over about 1 foot deep and then heavily manured. The seed was then sown in lines 9 inches apart in small beds; after sowing the beds were watered at first every day, and after the seed had germinated every second or third day until the plants were about 6 inches high, when gradually the supply of water was diminished, and when about 1 foot high watering was discontinued. This stopped the growth of the plants, but they still remained green; they were then transplanted out to form a hedge. In a few small beds enough plants were raised to form a hedge 500 yards long. Nearly all the plants grew after being transplanted; water was applied occasionally. By this means a cheap hedge can be raised very conveniently in a short time; the planting may be performed at any time during the dry season when there is little circulation of sap in the plants. This experiment having given very satisfactory results, some fresh beds have been sown to raise plants for some new hedges, as well as for filling gaps in the old ones.

Raising Corkapilly seedlings for fences.

127. It is intended to enlarge the nursery for educational purposes, and to raise a greater variety of trees for the instruction of the students of the School of Agriculture. If in other countries, where the management of private plantations and forests is under the strict control of the State, it is considered necessary that, besides forest schools, the Agricultural Colleges should afford instruction in raising and maintaining plantations and forests, then it cannot be considered superfluous to do something in this country where the existence and judicious maintenance of arboraceous plants can influence to so great a degree the agricultural conditions we meet with.

Necessity for education in forestry.

128. *Permanent Improvements.*—The greater portion of the buildings, situated on the land set apart for grazing purposes, have been removed; only one of the sheds has been retained; this has undergone a thorough repair and a tile roof has been substituted for thatch; this shed has been used several times for curing tobacco for which it is tolerably well adapted. The slopes of the irrigation channel at the west side of the Farm were planted with Guinea-grass when the weather was too wet to perform ordinary field operations; although nearly all the roots sprouted, a great difference was observable between the plants growing on the two sides of the channel. The grass grew much better on the slope exposed to the morning sun than on that exposed to the evening sun. This may perhaps be attributed to the sudden changes of temperature, which the soil exposed to the morning sun undergoes; as it is well known that a soil whose temperature often and suddenly changes is more quickly improved than one undergoing similar changes of temperature gradually. The cattle boxes have been put in thorough repair; the feeding troughs are now all built of brick-in-lime, and the division and outside walls are built with drainage pipes inserted in the walls, and are thus perforated and ample ventilation is obtained. The cattle are now most comfortably housed, none of them having been sick during the whole year. A concrete channel was built along the side of the yard, forming a boundary to it and admitting of water being conducted to the yard from the water-lift close by; by this means most of the cocoanut trees planted in the yard can be watered by gravitation. Most of these trees which were planted recently in the yard grew very well during the past year; they were once severely attacked by white-ants, but a heavy dressing of common salt stopped the work of the insects at once.

(Signed) K. SCHIFFMAYER,
Assistant Supt., Govt. Farms, in charge.

SAIDAPET,
26*th May* 1879.

GENERAL WORK OF THE DEPARTMENT.

1. *Correspondence.*—No diminution has taken place in this branch of our work, by its means a great amount of valuable information is annually diffused to persons taking an interest in land-management, planting, and agriculture. The following are some of the subjects on which advice has been sought:—

Subject of Question asked.	District whence received.
The means of getting Apple tree scions for grafting	Punjab.
Soils best suited for the cultivation of Wheat and the best season for sowing it	Coimbatore.
The method of raising a mixed crop of Cotton and Maize with the best advantage	Do.
The means of getting rid of the surplus vegetation on grazing lands infested by noxious insects	Madras.
The working capabilities of well-augers, and the nature of labor needed for their working	Do.
Whether the ryots of Chingleput distinguish between "Smut" and "Ergot"	Tinnevelly.
Fibre plants and oil-cake	Madras.
Whether the extraction of the oil found in locusts would prove a profitable undertaking, and the working capabilities of a Double Mhote ...	Madura.
The liberal privilege allowed by the State to the ryots of Kistna District as regards pasture land for the stock of the village on favorable terms of rent	Madras.
Information regarding Wind-mills	Guzerat.
Cultivation of Buckwheat as a fodder-producer	Kistna.
Opinion as to the cause of damage done by insects to certain heads of Cholum	Coimbatore.
Cotton culture	Cochin.
Cultivation of Guinea-grass	Malabar.
Opinion as to the quality of China Bean cake for feeding purposes ...	Madras.
Opinion as to the number of mares a donkey stallion would serve in one year in a season of three months	Do.
Introduction of Pekin Ducks on the Nilgiris	Ootacamund.
Books to be read to gain a general knowledge in agricultural matters, and the means of obtaining exotic agricultural seeds	Madura.
Works to be consulted to obtain a good information regarding the soils and manures especially suited to particular trees, vegetables, fruits and flowers, &c.	Madras.
The cost of maintaining an Agricultural College, and its general management	Poona.
Information as regards the outturn and value of Sugar and Indigo per acre	Chingleput.
The outturn of irrigated and unirrigated cereals and pulses per acre in India compared with that of England and America	Madras.
Method of storing Indigo seed in view to preserve its vitality	Do.
The success attending the raising of grasses from seed obtained from Queensland	Do.
Means of removing impurities from the gram supplied to the horses of the Commissariat Department; and the cost of the machine used in removing such impurities	Do.
Estimates for starting a Farm and a School of Agriculture in connection therewith	Guzerat.
Means of obtaining certain agricultural seeds and buffalo-grass roots ...	Nilgiris.

Subject of Question asked.	District whence received.
Means of obtaining wheels and their cost	Indore.
The utilization of Guindy Park in a stock-breeding experiment ...	Official.
The results of a further trial made with the double mhote with new and large buckets	Madras.
Curriculum and cost of the Madras Government School of Agriculture ...	Poona.
Experimental culture of "Sorghum Saccharatum" and "Planter's Friend" on the Shevaroys	Salem.
The working capabilities of a plough and the means of obtaining one of the best description to be used on red soils	Kistna.
Cost of constructing a double mhote	Madura.
Coffee-planting	Salem.
Ornamental gardening	Central India.
The outturn of Tanjore paddy land	Madras.
The richness of the dung of milch-cows when young or milking, or that of growing animals compared with the dung of other cattle, and the bearing it has on the question of grazing the rough pasture of this country ...	Nilgiris.
The supply of ploughs of European pattern with their price, &c.	Burdwan.
The cost of constructing a double mhote and its working capabilities ...	South Arcot.
Proposed experiment with a small herd of the Amrut Mahal breed of cattle on the Nilgiris or in the Coimbatore District	Official.
Seed affected by disease and the causes that lead to its infection ...	Bombay.
Cost of a double mhote	Salem.
The value of dried cattle-dung and dried bones and lime as manure ...	Tuticorin.
The districts in Madras Presidency which produce the best cotton; the comparative superiority of the cotton of Bellary, Coimbatore and Tinnevelly; the original habitat of the cotton plant; the characteristics of good cotton; the towns to which—in India and in Europe—the cotton from the Presidency is exported; the price of first and second-sort cotton per maund; the price of cotton-seeds per maund or measure; the description of cotton-seeds to be cultivated in the Punjab, Cashmere and Moradabad; whether the American or Egyptian varieties are good and whether they can be cultivated in any suitable land	Madras.
The establishment of Model Farms	Burmah.
Description of crops to be cultivated in a certain coffee estate with advantage and the time best adapted for their cultivation; description of manure to be used for coffee to obtain a good crop; the description of scythe to be employed in cutting weeds on coffee estates and its cost	Madura.
Opinion as to the working capabilities of certain ploughs sent by Messrs. Oakes and Co. for trial; and as to their general usefulness in this Presidency	Madras.
Means of obtaining a bone-mill	Do.
The value of distillery refuse as a manure	Do.
Information regarding the work of the School of Agriculture and the rules under which students are admitted into it	Punjab.
Culture of arrowroot and the manure to be used for mango trees ...	Tanjore.
Means of getting rid of rats committing great havoc to crops	Dharwar.
Information regarding the work of the School of Agriculture	Cawnpore.
Information regarding the conditions under which students supported by Native States are admitted into the School of Agriculture	Travancore.
Opinion as to the value of certain manure, the analysis of which was sent for inspection	Madras.
Information as to the grass-seed that will give a respectable sod ...	Chingleput.
Works to be consulted to gain a knowledge in the principles of agriculture	Salem.
The working of a bucket-pump; and the relative merits of Guinea-grass and Buffalo-grass as regards hardihood, quality and quantity of produce	Do.

The correspondence with the Board of Revenue is still large. During the year 184 letters were addressed to that body on various matters, departmental and agricultural. The following are some of the chief subjects referred to:—

Subjects.	Disposed of in the Board's Proceedings.	
	Number.	Date.
Enclosing extracts from a Report by the Commissioner for Agriculture, United States, affording useful information relative to the Migratory locust usually called Grass-hopper in the United States.	1,060	17th April 1878.
Report on the result of a small experiment made in Jute cultivation on the Saidapet Experimental Farm	1,124	29th April „
Forwarding an extract from the Annual Report of the Commissioner of Agriculture for the United States, affording information regarding the habits of the Migratory locust	1,151	1st May „
Submitting a report on the subsoil drainage experiment made on certain land in the Kottur Village of the Saidapet Taluk ...	1,326	16th May „
Submitting a report regarding the cost of making a plough of the Swedish pattern	1,925	11th July „
Report on the subsoil drainage experiments conducted on the Saidapet Experimental Farm	2,004	19th July „
Enclosing copies of reports affording information regarding the results of further attempts in cultivating *Sorghum saccharatum* and Planter's Friend in this Presidency	1,973	16th July „
Submitting a report as to the steps taken to impart to the Agricultural Community generally the lessons to be learnt from the operations conducted on the Saidapet Experimental Farm ...	2,112	31st July „
Suggesting that one of the Assistant Superintendents of Government Farms should perform a tour in some of the districts to acquire more detailed knowledge of local customs of the ryots by personal observation	2,442	3rd September 1878.
Forwarding an extract regarding the preparation of artificial Indigo.	2,684	1st October „
Submitting observations regarding the subject of establishing a Juvenile Criminal Reformatory for the reception of youths of the criminal classes on the Saidapet Farm	2,988	7th November „
Remarks regarding the agricultural condition of the Madras Presidency in 1872 compared with that of 15 years previous ...	3,030	12th November „
Remarks regarding the rainfall in the months of October and November 1878 compared with the average of the previous 8 years.	3,436	19th December „
Report regarding the results of the physical training of the students of the School of Agriculture	319	6th February 1879.
Suggestions for exhibiting the working of European ploughs to the ryots in the districts	375	11th February „
Suggesting that the attention of the Court of Wards and the Zemindars of this Presidency may be invited to the facilities the School of Agriculture affords for training Agricultural Instructors for future employment on the different Estates under their management	536	28th February „
Suggesting the Prize-Farm System for promoting good farming in this Presidency	682	14th March „
Explanations with reference to the Board's review of the report of the Department for the year ending 31st March 1878 ...	698	15th March „
Submitting an estimate showing approximately the cost that would be incurred in exhibiting the working of four improved ploughs in the District of Trichinopoly	691	15th March „
Information regarding the crops produced and the stock maintained on the Saidapet Farm during 1876-77 and 1877-78	732	19th March „

Extracts from the correspondence will be made and printed with this report.

2. *The Famine Commission.*—A portion of the series of questions propounded by this body having been referred by Government to this Department for reply, a memorandum was prepared and forwarded to Mr. G. A. Ballard in September 1878. It dealt chiefly with the following subjects :—

Rain required for the growth of our common crops under ordinary systems of cultivation, and under improved agriculture.
The benefits that deep cultivation can confer on the country by storing up and fully utilizing the rain that falls, and so averting the usual effects of drought.
Injurious effects of floods, and water in excess in other forms.
Great increase of population with corresponding extension of cultivation showing that the resources of the country are decreasing under the native system of agriculture.
System of collecting statistics unsound, and statistics unreliable.
Estimate of the food produced in the Presidency.
Produce per acre contrasted with the outturn obtained in Europe.

Value of wells in a time of drought, and the small area irrigated from them.
Proportionate areas under different food-grains and their nature.
Population supported in the Madras Presidency per square mile not large.
The use of manure in native agriculture ; the substances chiefly relied upon ; the area usually manured, and the amount available, with notes on manures still unutilized.
Absence of any system of rotation of crops, or of fallowing.
General belief in the exhaustion of our arable soils, and facts supporting the belief.
Decrease in proportion of live-stock maintained to the arable area.
Reasons for believing that a very large area of jungle has been felled during recent years, and the effects which this clearance must have had on the climate.
Necessity for extensive planting throughout the Presidency, and the advisability of rendering it obligatory on Government ryots to plant a portion of their holdings annually.
Irrigation water supplied should be paid for according to the amount consumed.
Small value of canal water, and its nature as its stimulant.
Necessity for providing adequate drainage.
Irrigation has extended the area under paddy—a low type of crop.
Backward state of Indian agriculture, and the necessity for improving it.
Early attempts of Government for improvement, which ended in failure.
The opening of the Saidapet Experimental Farm, and the work done since the year 1868.
Foundation of the School of Agriculture in 1876, and the advantages of general agricultural education.
Difficulty of showing the results of operations for the improvement of agriculture in a short time.
Necessity for demanding in Revenue Officers a knowledge of the principles of agriculture.
Greater prosperity to be hoped for from the improvement of the system of agriculture than from any extension of irrigation.

3. *Publications.*—A compilation from the reports of this Department has been made, and is ready for publication under the title of "The Saidapet Farm Manual and Guide."*

"It was prepared in order to bring together, in a form convenient for reference, the most interesting and valuable writings, referring to the practice of agriculture in this Presidency which are to be found scattered through the annual and special reports, submitted by the agricultural officers of the Madras Government during the past ten years ; many of these reports being either out of print or otherwise not available to the public. A short guide to the Saidapet Experimental Farm has been added to the compilation in order that the farmer and agricultural student may be able to comprehend the circumstances under which the results and experience narrated have been gained."

The practice of making extracts from the various newspapers, &c., supplied to this Department, for publication as a supplement to the *Chingleput District Gazette* has been continued during the year. It is to be regretted that so beneficial a custom is not extended to all District Gazettes.

4. *Distribution of Seeds and Models.*—The following seeds were distributed gratis by the Department during the year :—

Districts.	Sorghum.	Planter's Friend.	Yellow Cholum.	White Cholum.	Maize.	Cotton-seed.	Carolina Paddy.	Tobacco.	Corcapilly-seed.	Red and White Wheat.	Sundries.
	LB.	LB.	LB.	LB.	LB.	LB.	LB.	OZ.	LB.	LB.	LB.
Madras ...	21	21	...	...	1	10	11	2½	6	...	2
Chingleput ...	...	...	2½	...	3	32	5	...	...	...	18¼
Madura ...	5	...	¼	...	¾	30¼	...	...	...	...	¼
Coimbatore ...	...	...	...	...	1	2	...	...	...	115	...
Tanjore ...	2	...	...	...	3¾	...	...	...	...	...	...
Salem ...	...	...	...	...	...	2	...	2	...	...	...
Travancore ...	½	...	...	...	...	¾	...	...	5	...	1½
Nilgiris ...	...	...	...	...	...	...	...	...	...	200	...
Bellary ...	...	...	...	...	...	...	...	...	10	...	...
Vizagapatam ...	...	...	...	...	1	...	...	...	...	...	...
Ganjam ...	...	...	...	...	½	...	...	...	...	...	1½
Godavari ...	...	...	...	...	...	...	...	1	...	...	...
South Canara ...	50	30	...	...	...	...	...	...	...	...	...
Bombay ...	...	...	...	...	...	...	2	3	...	...	...
Jaffna ...	1	...	1	...	½	2½	...	...	...	...	2
Assam ...	1½	1½	1½	...	...	3	...	...	...	...	...
Brisbane ...	...	...	...	...	...	...	1½	¼	...	...	9
Madagascar ...	...	...	...	...	...	...	..	...	...	...	26
Total ...	81	52½	5¼	...	11½	82½	19½	8¾	21	315	60½

* Published July 15th, 1879.

Models of the double mhote were also distributed free of cost to persons in the districts named as below :—

District to which sent.	Madras.	Salem.	Madura.	Trichinopoly.	Kurnool.	Bombay.	Ahmedabad.	Hoshungabad.	Wardah.	Chittagong.	Brisbane.	Total.
Number	2	1	2	1	1	1	1	1	1	1	1*	13

Iron ploughs of English pattern were supplied gratis to the following gentlemen :—

Rev. S. J. Chowreappah, South Arcot.
„ W. S. Howland, Madura.

5. *Exchanges.*—The following Societies and Departments promised during the year to exchange their publications with those of this Department :—

Director of Botanical Gardens, Calcutta.
Director of Agriculture, North-West Provinces, Allahabad.
Secretary, Horticultural Society, Madras.
Secretary, Horticultural Society of India, Calcutta.
Secretary, Indian Section, Society of Arts, London.
Secretary, Cobden Club, London.
Secretary, Highland Agricultural Society of Scotland, Edinburgh.
Secretary, Agricultural Society of New South Wales, Australia.
Secretary for Agriculture, Victoria, Melbourne, Australia.
Director of Botanical Gardens, Brisbane, Australia.
Director of Botanical Gardens, Adelaide, Australia.
Secretary, Queensland Acclimatization Society, Brisbane, Australia.
Superintendent, Royal Agricultural Museum, Berlin, Prussia.
Director of Botanical Gardens, Butenzorg, Java.
Ministers of Agriculture, Rome, Italy.
Professor of Agriculture, University, Tokio, Japan.
Principal of the Canterbury Agricultural College, Christ Church, Canterbury, New Zealand.

6. *Finances.*—The following is an abstract of the income and expenditure of the Department during the year :—

	RS. A. P.	RS. A. P.	*Expenditure*—	RS. A. P.
Balance on the 1st April 1878 ...	...	1,91,215 13 7	General Supervision	20,782 8 3
Receipts—			Saidapet Experimental Farm ...	12,181 12 4
Provincial Grant...	20,000 0 0	...	Implement Workshops	1,730 0 4
Surplus Pound Fund	61,825 1 9	...	School of Agriculture	23,384 0 3
RS. A. P.			Estate Improvements	4,261 5 8
Saidapet Experimental Farm ... 2,539 6 2			Allowance to Surgeon for medical charge	848 11 4
Implement Workshops 1,720 14 7	4,260 4 9	86,085 6 6	Expenditure incurred by Public Works Department for the Farm	482 2 0
			Paid by transfer	91 8 0
			† Balance in favor of the Department on 1st April 1879 ...	2,13,539 3 11
Total ...	...	2,77,301 4 1	Total ...	2,77,301 4 1

Under the heading "*General Supervision,*" the expenditure during the year was Rupees 20,782-8-3, or Rupees 1,530-13-11, more than in the year 1877-78. The expenditure incurred on behalf of the *Saidapet Experimental Farm* was Rupees 1,186-6-0, more than what was expended last year; whilst Rupees 1,730-0-4 were spent to maintain the *Implement Workshops* against Rupees 2,030-10-5, the amount expended in the previous year. Rupees 14,801-6-1 were spent to meet the "ordinary" charges of the *School of Agriculture* against Rupees 13,544-9-1, the expenditure in 1877-78; and Rupees 6,999-4-0 were spent by the Public Works Department during the year for constructing a Laboratory and for providing temporary sheds. Under the heading *Estate Improvements*, the expenditure during the year was Rupees 4,261-5-8 or a little less than half of the expenditure incurred in the previous year. The Public

* 1 model of the picottah was also sent to Brisbane in exchange for seeds, &c., received.

† This balance is not absolutely correct, as some transfer accounts have not been settled by the Accountant-General.

Works Department also spent Rupees 482-2-0 for a channel from the Chembrambaukum Tank, which is as yet altogether useless. The total expenditure during the year was Rupees 63,762-0-2 against Rupees 62,911-13-5, the amount spent in 1877-78. Rupees 61,825-1-9 were received from the Surplus Pound Fund, which with Rupees 4,260-4-9, the amount realized during the year by the sale of Farm produce and of the machines, &c., manufactured in the workshops attached to the Farm, makes a total income of Rupees 66,085-6-6 against Rupees 56,938-6-3 received in 1877-78.

A statement of the accounts of the Department in detail is appended to this report.

7. *Establishment.*—No changes were made in the establishment during the year. I delivered over charge of the Saidapet Experimental Farm to Mr. Schiffmayer early in April, after which until the close of the year that officer remained in charge. After my return from privilege leave in July, Mr. Robertson availed himself of similar leave granted to him, and during his absence I officiated for him, as I did also during his deputation in Bombay. The conduct of the subordinates of establishment has, on the whole, been satisfactory.

CHARLES BENSON, M.R.A.C.,
Ag. Supt. of Govt. Farms, Madras.

SAIDAPET,
29*th May* 1879.

OUR FOOD-SUPPLY.*

1. The following figures show the proportionate area under the various cereal and pulse crops in the Presidency, and from them it will be seen that the chief food-grains are paddy, cholum, and cumboo :—

Area cropped with	Acres.	Proportion.
Wheat (*Triticum spelta*) ..	19,000	·10
Paddy (*Oryza sativa*)	5,584,000	28·02
Cholum (*Sorghum vulgare*) ..	4,610,000	23·13
Cumboo (*Penicillaria spicata*) ..	2,909,000	14·60
Raggy (*Eleusine corocana*) ..	1,636,000	8·20
Inferior cereals†	3,096,000	15·53
Pulses	2,077,000	10·42
Total ..	19,931,000	100·00

It may be noted that of all these crops the only one which especially needs manure is wheat, whilst the difference between the inferior cereals and the uncultivated grasses is, in the scale of vegetable life, infinitesimal; whilst I may quote here the following expression of opinion by Professor Church, of the Royal Agricultural College, Cirencester, regarding our pulses :—

"Many of the leguminous plants are little better than unimproved weeds."

2. Regarding the supply of food-grain in the Presidency, it may be observed that the population of the Government lands, that is of all the country excepting the Zemindaries, is about 24 millions; the consumption of food is probably not much less than 1·4 lb. of grain a head per diem, or 7 lb. by a family of 5 persons, making an annual demand of 120 million cwts. The amount of seed used per acre of arable land sown with food-grains is probably not less than 56 lb., or ·5 cwt., thus causing a demand on the Government lands of 10 million cwts. The annual exports and imports nearly balance each other, so that the total demand from the soil for the support of the population is about 130 million cwts. In the lands belonging to Government there are annually about 5 million acres under irrigated paddy, 13 million acres under unirrigated cereals, and 2 million acres under pulses. According to the best available data, those collected in making the settlement, allowing for bad years, and the preponderance of the poorer classes of soils, the following may be taken as the average outturns :—

	Cwts.		lb. per Acre.
Paddy	9	or	1,008
Unirrigated cereals	5·5	or	616
Pulses	4	or	448

At these rates the annual product of Government lands would be—

	Million Cwts.
Paddy	45
Unirrigated cereals	71·5
Pulses	8
Total Food-grain ...	124·5

This includes the product of second crop.

* The greater portion of this paper was laid before the Famine Commission.

† Including Varagu (*Panicum miliaceum*); Koralu or Tennai (*Panicum Italicum*); Shamai (*Panicum miliare*).

3. The area of the Zemindari lands is about $\frac{1}{3.27}$ of that of the Government lands, so that the product of them, assuming a similar proportionate area is under crop, may be taken as follows :—

	Million Cwts.
Paddy	14
Unirrigated cereals	22
Pulses	2·4
Total Food-grains ...	38·4

The lands which produced this food would require 3 million cwts. of seed-grain and sufficient food for a population of about 8 millions, or 37 million cwts., making a total demand from the Zemindari lands of 40 million cwts. The balance sheet of the Presidency may be shown as follows :—

—	Million Cwts.	Million Cwts.
Demand for food	157	..
Do. for seed-grain	13	170
Supply Government villages ..	121	..
Do. Zemindaries	38·4	159·4

Showing a deficiency of 10,600,000 cwts. or about 6 per cent., which is probably accounted for by too high an estimate of the daily consumption per head being taken. These figures agree with general experience, which has shown that the state of existence of the poorer ryots and laborers is usually one of simple subsistence only; a slight deficiency of crop causing them want; a large, starvation; there is no margin to lay by for evil times; and too often the ryot, who could lay by, spends his little savings in a marriage or a festival.

4. Mr. Robertson considered the figures given above to be high, and explained his reasons for holding such a belief as follows :—

" My own reasons for believing the figures given by Mr. Benson to be high average ones are :—

1st.—My general experience of the Presidency, now extending over ten years, during which time I have seen a considerable portion of the country, the knowledge thus gained having been supplemented by an extensive acquaintance with official records relating to the agriculture of the Presidency and by considerable opportunities for learning the opinions of men familiar with native husbandry from all parts of the Presidency.

2nd.—My special experience regarding the Coimbatore District, which it must be acknowledged is one fairly representative of the whole Presidency.

That the Coimbatore District is a fairly representative one the following facts will show :—

——	Coimbatore.	Average of the Presidency.
Population per square mile	237·3	226·2
Houses per do.	48·6	45·
Persons per house	4·89	5·02
	RS. A. P.	RS. A. P.
Incidence of land revenue per head of population	1 6 8	1 6 8
Assessment per acre—		
Wet land	7 5 0	4 9 0
Dry land	0 14 3	1 1 0

That the cropping of the Coimbatore District is very similar to that of the rest of the Presidency the following figures, showing the percentage of area of each class of crop raised, will prove :—

Area under	The whole Presidency.	Coimbatore.
	PER CENT.	PER CENT.
Cereals	76·28	77·89
Pulses	9·05	8·90
Oil-seeds	5·54	3·44
Indigo	1·10	..
Cotton and other special crops ..	6·14	7·81
Garden crops	1·89	1·96
Total ..	100·00	100·00

The following figures have been compiled from a statement furnished me by Mr. Wedderburn showing the area cultivated in the Coimbatore District with each crop and the produce obtained during the Fasli 1284 (1874-75). Regarding the season of the year Mr. Wedderburn in his jamabundi report states :—"The past year was an average one." The figures are as follow :—

Description of Corn.	Area under Crop in Acres.	Total yield in Garce of 3,200 Measures.	Yield per Acre in Pounds.
Paddy	91,410	16,858	1,254
Dry Grains—			
Cholum	680,197	74,936	882
Wheat	2,235	138	495
Raggy	221,642	16,132	582
Varagu	8,143	348	342
Cumboo	812,991	30,989	305
Dholl	14,799	928	500
Tennai	38,521	1,675	347
Shamai	109,007	7,160	525
Average of all dry grains ..	..	..	560
Pulses—			
Oolunthoo or black-gram	7,987	183	219
Bengal-gram	9,684	222	219
Mochai or avarai	24,732	528	204
Horse-gram	157,996	4,781	291
Tattapairu	9,143	145	150
Naripairu	4,422	157	342
Patchaipayar or green-gram	9,698	179	177
Average of all pulses ..	..	..	267

The measure is taken in these calculations to hold—

$2\frac{1}{8}$ lb. of paddy.
$2\frac{1}{2}$ lb. of dry grain.
3 lb. of pulse.
} All high average weights.

From the above statement it will be seen that in this representative district the outturn of—

	LB.		CWT.
Paddy is stated to be	1,254	or	$11\frac{1}{4}$
Unirrigated—			
Cereals is stated to be	560	or	5
Pulses is stated to be	267	or	$2\frac{1}{2}$

In every case, excepting that of the *paddy*, the figures being considerably lower than those of Mr. Benson's estimate. That the outturn of paddy in this district should be higher than the average of the Presidency is not surprising, seeing that, as shown by the figures given above at paragraph 4, it is clear that the irrigated lands of the district pay a rent 60 per cent. higher than the average of the Presidency for similar lands.

The Board themselves, I believe, looked upon the Coimbatore District as being better farmed than the average of the Presidency, for in paragraph 7 of their Proceedings, No. 1,334, dated the 17th of May 1875, they particularly held it up as a specimen to be studied, and themselves selected it as the one in which I should first perform a tour."

5. The figures are moreover supported by the fact that, according to the Director of Revenue Settlement, in the Trichinopoly District, the outturns are higher than the average per acre of the whole Presidency, as the following figures show :—

—	Average of the Presidency.	Trichinopoly.
	LB.	LB.
Paddy	1,621	1,678
Cholum	666	690
Raggy	770	834
Cumboo	630	638
Varagu	950	1,208

How these figures were arrived at, I am unable to state, but, as we do not know, nor have we ever known, the area of the different crops grown on the different classes of lands, it is manifestly impossible to calculate the average outturns by the crops individually, and the only reliable method for arriving at the true produce of food-grain is one similar to that adopted by me in my report of my tour in the Trichinopoly District (paragraph 10), where I have shown that, according to Mr. Puckle's figures, the average outturn in that district, which, be it remembered, produces more heavily than the rest of the Presidency, was in 1864 for—

	lb. per Acre.
Irrigated paddy (first crop only)	1,280
Unirrigated cereals	570

and that there is reason to believe that the present outturn is even less.

6. It has been said that, because my estimate shows a deficiency in the supply, my figures of produce must be wrong; but if I take the figures adopted by the Board of Revenue for the average daily consumption per head, viz., 1·25 lb. instead of 1·4 lb. which I assumed, the demand for food will be reduced immediately by 10·7 per cent. and the Presidency will be shown to have an annual excess produce of 6,199,000 cwts. of food-grain; an amount more than sufficient to account for the reserves which must have existed before the famine.

7. It may not be out of place to observe here that there is every reason to believe that the people of this country are not nearly so great vegetarians as is commonly supposed; that all excepting a few castes will eat animal-food, excepting beef, is well known, and the annual disappearance of at least one million head of goats and sheep, the natural increase of the herds, cannot be accounted for in any other way than that they are slaughtered for human food. The consumption in the city of Madras alone demands the annual slaughter of 8,000 bullocks and of 220,000 sheep and goats.

8. The use of fish as an article of diet is very general wherever it can be procured, and this fact points to the necessity that exists for the better utilization of the existing means of producing this valuable food. It is very generally admitted that during the famine our sea fisheries were not fully made use of. The means existing for pisciculture in our tanks, ponds, rivers, &c. are great, but unutilized.

9. Before concluding I would draw attention to the common mistake made in believing that India, or at least Southern India, supports a teeming population, or a population even in numbers alone in excess of that supported in some European countries. Of this the following figures are conclusive :—

	Population per Square Mile.
Madras Presidency	226·2
Belgium	471·0
Great Britain	297·6
Holland	285·8
Italy	268·0
France	176·7

In only one district of the Madras Presidency (Tanjore) is the population per square mile of Belgium exceeded, whilst in 13 it does not reach that of Italy.

But the annual consumption of food-stuffs per head of population is far greater in Europe than in India, probably at least double, so that India should be able to support a population twice as numerous as that of Belgium, whereas in Madras it only does about half. This is supposing that the percentage of cultivable land is the same, and that an equal proportion of land is devoted to industrial products, such as wool and textile or oleaginous crops, &c., and also that the land is capable of producing an equal outturn per acre if similarly worked.

10. How miserable is the yield of the staple crops of the Presidency has already been mentioned; the following figures give some details regarding the produce of crops in Europe :—

Country.	Average yield per Acre.	
	Wheat.	Pulses.
	LB.	LB.
Great Britain	1,800	1,700
Belgium	1,680	1,470
Holland	1,500	1,680
France	1,030	1,000
	CEREALS.	PULSES.
Madras	700	450

But the smaller yield obtained in this Presidency is not, I believe, due to the soil being of less natural fertility or the climate less favorable, but to a degraded agricultural system.

(Signed) CHARLES BENSON, M.R.A.C.,
Ag. Supt. of Govt. Farms, Madras.

SAIDAPET,
June 1st, 1879.

VARIATIONS IN THE COMPOSITION OF GRAIN.

1. The following extracts are taken from an essay by Professor Henry Tanner, M.R.A.C., published in the last journal of the Highland and Agricultural Society of Scotland. They are particularly interesting.

"The inquiry was also extended so as to include those cases in which by skilful management difficulties of soil and climate were surmounted, and to show the influence which was thus exerted upon the production of food. In one case we found the good and the bad management of land, fairly similar in natural character, and under similar conditions of climate, producing crops exceedingly different in quantity and quality. Under good cultivation we found 50 bushels of oats weighing 43 lb. per bushel, produced from one acre of land; and only 10 bushels, weighing 22 lb. per bushel, yielded by another acre of similar land. The chemical analysis of these specimens of oats gave the following results:—

—	Composition of Oats grown under	
	Good Cultivation.	Bad Cultivation.
True albuminoid matters (gluten)	7·18	1·58
Starch, gum, &c.	61·69	64·49
Fatty matter	2·88	1·68
Cellulose	9·10	16·36
Nitrogenous matter (not true albuminoids)	3·32	1·21
Containing nitrogen	(·524)	(·190)
Alkaline salts in ash	1·20	1·05
Earthy salts in ash	·58	·82
Silicious matter in ash	·70	·88
Water	13·35	11·93
	100·00	100·00

The production of food in these instances also showed how greatly good cultivation enables the yield of corn to be increased in quantity, and at the same time that it becomes of greater value. The composition of the oats produced upon each imperial acre may be stated as follows:—

—	Acreage yield of Oats under			
	Good Cultivation.		Bad Cultivation.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	154½		3½	
Fat and heat-producing matter	1,388¼		145½	
		1,542¾		149
Substances of little or no use as food—				
Cellulose, &c.	267		38½	
Mineral matter	53¼		6	
Water	287		26½	
		607¼		71
		2,150		220

Great as such variations as these are for the same extent of land, we shall obtain even more accurate ideas of the differences in the feeding value of the produce, by comparing the composition of one bushel of each growth:—

—	Composition of one Bushel of Oats grown under			
	Good Cultivation.		Bad Cultivation.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	3		½	
Fat and heat-producing matter	28		14½	
		31		15
Substances of little or no use as food—				
Cellulose, &c.	5¼		3¾	
Mineral matter	1		½	
Water	5¾		2¾	
		12		7
Weight per Bushel ..		43		22

These results are peculiarly instructive as showing what most probably is the composition of the grain grown under the ordinary systems of culture in this Presidency, compared with what it might be if grown under good cultivation. It will be seen that not only does the crop grown under bad cultivation yield less, but the produce contains a smaller supply of nutriment and its composition is much poorer than when grown under good cultivation.

2. The following figures are interesting, as we have so much land which not infrequently suffers from supersaturation with water:—

"The influence exerted upon the quality and the yield of oats, by the more or less perfect drainage of the land, was also examined. The produce of two fields, having soils of similar character, and situated under similar conditions of climate, was found to differ as follows:—

The land, which had been properly drained, yielded 38 bushels of oats per imperial acre, weighing 42½ lb. per bushel, whilst the undrained land gave only 26 bushels of oats, weighing 37 lb. per bushel. The chemical analysis of these specimens of oats gave the following results:—

—	Composition of Oats grown upon	
	Drained Land.	Undrained Land.
True albuminoid matters (gluten)	7·79	7·03
Starch, gum, &c.	54·58	55·67
Fatty matter	4·23	3·56
Cellulose	14·86	14·90
Nitrogenous matter (not true albuminoids)	2·50	1·79
Containing nitrogen	(·395)	(·282)
Alkaline salts in ash	·42	·86
Earthy salts in ash	1·14	·72
Silicious matters in ash	·93	·78
Water	13·55	14·69
	100·00	100·00

From these data we are able to show the acreage of production of food in these two instances, and thereby indicate the difference which may be fairly traceable to the influence of drainage.

—	Acreage yield of Oats grown on			
	Drained Land.		Undrained Land.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	126		67½	
Fat and heat-producing matter	949½	1,075½	570	637½
Substances of little or no use as food—				
Cellulose, &c.	280¼		160½	
Mineral matter	40¼		22¾	
Water	219	539½	141¼	324½
		1,615		962

The variations in the quality of the oats will be seen from the composition of one bushel of each of these crops:—

—	Composition of one Bushel of Oats grown upon			
	Drained Land.		Undrained Land.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	3¼		2½	
Fat and heat-producing matter	25	28¼	22	24½
Substances of little or no use as food—				
Cellulose, &c.	7½		6	
Mineral matter	1		1	
Water	5¾	14¼	5½	12½
Weight per bushel ..		42½		37

3. The influence which the seed used has on the quality of the produce is clearly shown in the next extract:—

"One of the most interesting and probably one of the most important influences affecting the production and the quality of oats, is that exerted by the seed. We found land of similar character and under similar conditions of climate, producing crops differing from each other in a very marked degree, and in the case examined, that variation was fairly traceable to the influence of the seed. The chemical analysis of the corn so grown gave the following results:—

—	Composition of Oats grown from Seed of	
	Good Character.	Bad Character.
True albuminoid matters (gluten)	5·89	2·72
Starch, gum, &c.	62·94	64·20
Fatty matter	2·81	3·92
Cellulose	11·70	12·98
Nitrogenous matter (not true albuminoids)	1·18	·50
Containing nitrogen	(·186)	(·079)
Alkaline salts in ash	·07	·50
Earthy salts in ash	·57	1·32
Silicious matter in ash	1·98	·90
Water	12·86	12·96
	100·00	100·00

The produce obtained from the seed having a good character was 35 bushels of oats per imperial acre, weighing 41 lb. per bushel, whilst the seed of bad character produced 22 bushels, weighing 20 lb. per bushel. The composition of the produce of one acre of each of these crops was as follows : —

——	Acreage yield of Oats grown from Seed of			
	Good Character.		Bad Character.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh forming-matter	84½		12	
Fat and heat-producing matter	943½		295¼	
		1,028		307¼
Substances of little or no use as food—				
Cellulose	185		63¾	
Mineral matter	37½		12	
Water	184½		57	
		407		132¾
		1,435		440

The variations in the feeding powers of the oats so grown will be more clearly seen from a statement showing the food contained in one bushel of each crop :—

——	Composition of one Bushel of Oats grown from Seed of			
	Good Character.		Bad Character.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	2½		½	
Fat and heat-producing matter	27		13½	
		29½		14
Substances of little or no use as food—				
Cellulose	5¼		3	
Mineral matter	1		½	
Water	5¼		2½	
		11½		6
Weight per bushel ..		41		20

In speaking of seed of good or bad character, I do not simply refer to that external appearance or condition which is generally observable, but also to that hidden constitutional character which subsequently enables the plant to struggle successfully against difficulties of growth. It is well known that seeds which differ but little in appearance, may have constitutional powers which will manifest themselves in unfavorable seasons, when the plant has to contend with adverse conditions. Nor must we limit the evidences of these influences to unfavorable seasons, although they give under such circumstances undeniable proof of their power, but we should, on the other hand, constantly acknowledge the truth of this hidden influence. In dealing with animal life we readily admit that we can intensify and render more permanent any desirable points of character. In vegetable life something has been done to establish in seed those distinctive characteristics which we desire to perpetuate, but very much more yet remains to be accomplished.

Closely associated with this influence, is that which arises from "change of seed," by which is generally understood making use of a suitable seed grown in another district, or upon soil of a different character. In the case examined we found that the crop of oats grown after a "change of seed" yielded 46 bushels of oats per imperial acre, and these weighed 43 lb. per bushel, whilst upon the same land the crop grown without such change of seed produced only 24 bushels of oats, weighing 32 lb. per bushel. The chemical analysis of these crops were as follows :—

——	Composition of Oats grown	
	With change of Seed.	Without change of Seed.
True albuminoid matters (gluten)	7·66	5·23
Starch, gum, &c.	60·90	59·77
Fatty matter	2·45	4·07
Cellulose	11·55	15·10
Nitrogenous matter (not true albuminoids)	2·62	·48
Containing nitrogen	(·413)	(·076)
Alkaline salts in ash	1·41	·55
Earthy salts in ash	·35	1·31
Silicious matter in ash	·25	·91
Water	12·81	12·58
	100·00	100·00

The difference thus arising in the production is shown by a statement of the food produced by one acre of each crop :—

——	Average yield of Oats grown			
	With change of Seed.		Without change of Seed.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	151½		40	
Fat and heat-producing matter	1,253	1,404½	490¼	530¼
Substances of little or no use as food—				
Cellulose, &c.	280¾		119¾	
Mineral matter	39¾		21¼	
Water	253½	573½	96¾	237¾
		1,978		768

For the convenience of examining the feeding value of these oats, the composition of one bushel of each growth is added :—

——	Composition of one Bushel of Oats grown			
	With change of Seed.		Without change of Seed.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	3¼		1½	
Fat and heat-producing matter	27¼	30½	20½	22
Substances of little or no use as food—				
Cellulose, &c.	6		5	
Mineral matter	1		1	
Water	5½	12½	4	10
Weight per Bushel ..		43		32

4. These figures speak for themselves and do not require any comment; but they also show what necessity there is for obtaining detailed information regarding the grains of this country before one can speak of their feeding value, as is often done on the strength of the analysis of some museum samples. It also shows what a wide field for the research in agricultural chemistry exists here.

(Signed) CHARLES BENSON, M.R.A.C.,
Ag. Supt. of Govt. Farms, Madras.

SAIDAPET,
2nd June 1879.

THE GERMAN AGRICULTURAL EXPERIMENTAL STATIONS.*

By H. L. DeKlenze, ph.d., m.a., *Director of the Royal Bavarian Experimental Dairy Station at Weihenstephan, Bavaria.*

Twenty-five years ago the first experimental station for scientific agriculture was instituted at Möckern, in Saxony, and it may not be uninteresting to look back at the development and the work of this and all the other German experimental stations during this last quarter of a century.

A new era for the advancement of agriculture began with our great Liebig, whose work "Chemistry in its relation to Agriculture and Physiology," came down like a stroke of lightning (A.D. 1840) amongst the scientific men of the age. But not only these took up his ideas, also practical men saw that through continued scientific research a foundation for the development of successful practical farming might be laid, because they then felt the want of knowledge and understanding of those physical, physiological, and chemical processes, which were passing every day under their very eyes. How can results be calculated if one does not know exactly the conditions under which they are attained!

In Saxony Petzhold and Stöckhardt began by lecturing before farmers on the above mentioned subject, and in 1845 a petition was sent by them and others to the Saxon Chambers, advocating the appointment of four chemists, each to lecture on agricultural chemistry, analyse soils and manures, and travel in one of the four provinces of the kingdom, to give advice to the farmers. This petition was not granted, however, as the persons in office did not think the right time yet come. This waiting and letting the fruit ripen too long, so that somebody else plucks it first, is one of our national faults, and an obstruction to rapid development. At the same time, the principal agricultural society of Saxony had reported to the ministry on the advisability of giving the agriculturists an opportunity to study agricultural chemistry; and in accordance with this proposal, after two years of deliberation, Stöckhardt was appointed Professor of Agricultural Chemistry at the Agricultural and Arboricultural College at Tharand, where he began work with investigations on forestry and physiology. In 1850 Councillor Reuning, then Secretary of the Saxon Agricultural Societies, began to open negotiations with different agriculturists to find a suitable farm on which chemical experiments could be conducted on a larger scale, and the result was that an experimental station was instituted at Möckern, a farm of sixty acres, near Leipsic, which belonged to the principal agricultural association of Saxony. As chemist Dr. Emil Wolff was engaged, who is now Director of the Experimental Station at Hohinheim, in Wurtemberg, and has spent half of his life in making thousands of analyses of feeding-stuffs, &c., and whose tables on the chemical and nutritive components of everything used for food are known and in use all over the world.

At first the new institution had only a private character; indeed, a large farmer, Mr. Crusius, paid most of the expenses out of his own pocket, but in 1852 help came from the State, and the agricultural societies and the experimental station at Möckern, the first in Germany, was instituted formally. The twenty-fifth year of existence of this first of the German experimental stations was duly celebrated in September last at Möckern, where many of the directors of German experimental

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* Prize Essay from the journal of the Highland and Agricultural Society of Scotland, 1878.

stations met for this purpose. Both Stöckhardt, or as we disciples of his branch of science call him, "Papa Stöckhardt," and Wolff were present, both much moved by the reminiscences of these hard days when agricultural chemistry lay still in its cradle and by the warm and kindly greeting they received from old and young in the brotherhood. Also a lasting memorial was given to the guests in shape of a book containing all statistical and historical material which was available to give a history of the development of the German agricultural stations. It was written by Professor Nobbe of Tharand,* and its valuable material has been of much use to me in the compilation of these notes.

I will enumerate now the German agricultural stations and append some notes which show their year of foundation, the number of their directors and assistants, their yearly income and their fields of research:—

Name.	Year of Foundation.	Directors.	Assistants.	Yearly Income.	Researches are made on
				Mark.	
Prussia.					
1. Insterburg	1858	1	...	6,000	Chemical-technical subjects.
2. Konigsburg	1875	1	...	6,050	Technology and physiology of plants.
3. Danzig	1876	1 1	... ...	12,900	Climate and crops. Control of the seed-market.
4. Dahme	1856	1	3	12,300	Physiology of plants; controlling of seed-dealers; analyses of artificial manures.
5. Berlin	1874	1	2	15,300	Distillery and Zymotechnic.
6. Regenwalde	1863	1	2	7,000	Soils and physiology of plants.
7. Posen	1877	1 1	... ...	10,000	Feed of animals. Manures and cropping.
8. Zabikowo	1872	1 1	1 ...	6,575	Agriculture in general. Physiology and raising of plants; control of seeds.
9. Breslau	1877	(?)	(?)	(?)	(?)
10. Froskau	1869	1	3	11,400	Feeding and physiology of animals.
11. Froskau	1872	1	2	1,500	Diseases of plants, specially of fruit-trees.
12. Breslau	1875	1	...	1,000	Control of the seed-market.
13. Hallee	1855	1	4	31,600	Growing of crops; trials of artificial manures and feeding of animals; control of artificial manures.
14. Halle	1862	1	4	(?)	Pathology and physiology of plants; trials of manures.
15. Kiel	1870	1 1	2 ...	8,700	Physiology of plants; chemistry of animal elements. Dairying.
16. Kiel	1874	1	...	(?)	Control of the seed-market.
17. Gottingen	1857	1	2	8,310	Feeding of animals.
18. Gottingen	1876	1	...	(?)	Control of seed-dealers.
19. Hildesheim	1870	1	2 or 3	12,400	Manufacturing of beet sugar, and analytical methods.
20. Bremervorde	1876	1	...	(?)	(?)
21. Münster	1879	1	2	13,100	Control of the seed, manure, and food-markets.
22. Altmoroschen	1857	1	1	8,250	Physiology of plants; soils, and meteorology.
23. Marburg	1877	1	...	(?)	Control of the seed-market.
24. Weisbaden	1868	1	2	7,150	Chemistry of the vine and the fermentation, &c. of wine.
25. Geisenheim	1872	1 1	... ...	(?)	Physiology of the vine. The fermentation, &c. of wine.
26. Bonn	1855	1	1	10,000	General questions of agricultural practice.
27. Poppelsdorf	1868	1	2	4,200	Chemical and physiology of plants.
28. Poppelsdorf	(?)	1	...	(?)	Control of the seed-market.
Bavaria.					
29. Munich	1857	1	3	12,000	Analyses of artificial manures, food, &c.; experiments on physiology of cattle and plants.
30. Munich	1875	1	1	3,500	Cropping; agricultural physics.
31. Augsburg	1865	1	1	3,500	Control of the artificial manure and seed-market.
32. Weihenstephan	1866	1	1	According to want.	Brewery.
33. Munich	1866	1	4	21,000	Brewery.
34. Weihenstephan	1877	1	...	4,600 for current expenses, others according to want.	Dairy (scientific and practical researches on milk, butter, and cheese.)

* Festschriftzur Feier des 25 Jährigen Tubiläums der Versuchs—Station Möckern Die Landwirthschaftlichen Versuchsstationem, Bd. xxii, herausgegeben von Professor Dr. Nobbe. Berlin, 1877.

Name.	Year of Founda-tion.	Directors.	Assistants.	Yearly Income.	Researches are made on
Bavaria—(Continued).				Mark.	
35. Triesdorf	1874	1	1	1,500	General agriculture.
36. Bayreuth	1867	1	...	1,050	Manures, foods, and seeds.
37. Speier	1877	1	1	7,700	Agricultural and wine analyses.
38. Landshut	1876	1	...	(?)	(?)
39. Wurzburg	1877	1	2	2,300	Manure for vineyards; disease of vines; fermentation of the wine.
Saxony.					
40. Möckern	1852	1	3	14,892	Feeding of cattle.
41. Pommritz	1854	1	3	17,770	General agriculture.
42. Dresden	1862	1	1	3,000	Physiology and pathology.
43. Tharand	1869	1	2	6,515	Physiology of plants.
44. Döbeln	1872	1	1	1,962	Soils.
Würtemberg.					
45. Hohenheim	1865	1	2	12,000	Feeding and analyses of feeding.
Baden.					
46. Karlsruhe	1859	1	2	(?)	Vine culture and wine.
47. Karlsruhe	1872	1	1	2,400	Control of the seed-market.
Hessen.					
48. Darmstadt	1871	1	1	9,800	Manures.
Oldenburg.					
49. Oldenburg	1871	1	...	3,800	Soil.
Braunschweig.					
50. Braunschweig	1862	1	2	10,000	Chemical and technology.
Macklenburg.					
51. Rostock	1875	1	2	16,800	Physiology of plants and cropping.
52. Raden	1876	1	1	9,200	Dairying.
Weimar.					
53. Tena	1861	1 1 1 1	1 1 2 ...	2,500	Agriculture. Physiology of plants. Chemistry. Physiology of animals.
54. Zwätzen	1875	1	...	(?)	(?)
Gachsen Meiningen.					
55. Eisfeld	1872	1	...	600	Control of artificial manures.
Anhalt.					
56. Cothen	1864	1	1	7,700	Physiology of animals and plants.
Elsass—Lothringen.					
57. Rufach	1874	1	1	6,000	Physiology of plants and chemistry of wine production.
Bremen.					
58. Bremen	1874	1	3	17,400	Reclaiming of swamps, bogs, and other waste lands.
59. Leipzig	1875	...	...	...	Twenty-three agricultural colleges and experimental stations have united to try the different kinds of potatoes by experiment, and publish the results.

If we count up the annual expense incurred by the German agricultural stations as above mentioned, we find it at about 550,000 marks, but in a great many of these stations the salaries are paid from other sources and not included in the income mentioned; other stations have no settled income, but use as much as they want, and, considering these circumstances, I do not overrate the amount of money we spent annually on our stations when I put it down at 600,000 mark or £ 30,000. This is indeed a large sum, and if our stations had nothing else to do than to make researches on agricultural chemistry, I have no doubt that this whole branch of science would have been sifted to the very bottom, as far as the chemical knowledge of the day fallows it; for we cannot get much further in

physiology, for instance, if we do not find out the constitution, &c. of the albuminates. But these institutions are principally occupied with supplying local wants, in making analyses, and controlling the markets for artificial manure, feeding-stuffs and seeds. The adulteration of artificial manures was so effectually stopped by the stations that the dealers were compelled to submit to their regular control, so that an adulteration is now very risky as the buyers simply send a sample of the manure in question to the next station, where it is analysed, and defects are easily found out. It is the same with the seed-market. Every farmer knows that not all the seed is good which is offered, and that it only too often happens that seed is bought which has either lost all powers of germination, or which is largely mixed with seeds of weeds, &c. The larger dealers in agricultural seeds have now been obliged (by the *vox populi*) to submit to the control of the stations, who also in this case protect the interest of the practical farmer. The third market, the market of feeding-stuffs, had also been hitherto a bad one, because the farmer was without help against the adulteration of linseed and other cakes, and many other feeding-stuffs. Now the experimental stations control most effectively these three branches of business, all of which are so important for the practical farmer. No less than 33 stations are almost continually employed with controlling analyses of artificial manures; 29 with proving the purity and genuineness of agricultural seeds; and 27 with testing the quality of feeding-stuffs. It may be now understood why the adulteration of the above named substances cannot now gain ground, as such attempts are immediately followed by detection and punishment.

I come now to another part of the question, namely, the scientific work which the German stations have done since their institution, and to show the extent of it I must give a list of the different subjects which have been pursued by experiment, and of which a considerable number are solved, or partly solved, while others still remain in obscurity, and most probably will stay there for some time to come. This list was compiled by Professor Nobbe, and I give it here in translation :—

I. Sources of nourishment for the plants—

- *A.* Atmosphere.
- *B.* Water.
- *C.* Geological strata and the influence of the weather on them.

II. Arable land—

- *A.* Formation of soils.
- *B.* Physical and chemical character of the soils.
- *C.* Analyses of soils.
- *D.* Melioration.

III. Physiology of plants—

- *A.* Nourishment of the plants—
  - (*a.*) Mineral substances.
  - (*b.*) Compounds of the mineral substances as nourishments for the plants.
  - (*c.*) The roots in their action on the soil. Growing plants in solutions.
  - (*d.*) The organs of the plants which are above ground in their relation to the atmosphere.
  - (*e.*) Movement of nourishing elements in the plants.
  - (*f.*) Genesis, metamorphosis, and characteristics of the organic products of the plants.
- *B.* Influence of physical agencies on plants—
  - (*a.*) Germination (agricultural seeds, control of seeds).
  - (*b.*) Development of the organs.
  - (*c.*) Production of vegetable matter.
  - (*d.*) Reproduction.
- *C.* Diseases and misformations of the agricultural plants; destructive influences of parasites; destructive influences of fungi; destructive influences of animals.
- *D.* Chemical composition of the plants; General questions; Lichenes; Coniferæ; Gramineæ; Palmæ; Naiadaceæ; Cupuliferæ; Moreæ; Chenopodaceæ; Compositæ; Labiatæ; Solanaceæ; Umbelliferæ; Papaveraceæ; Cruciferæ; Ampelideæ; Coryophyllaceæ; Euphorbiaceæ; Drupaceæ; Papilionaceæ.

IV. Manuring—

Analyses of fertilisers:—

1. Stable manure, urine, compost.
2. Manure from closets and sewers.
3. Disinfectants.
4. Guano and other nitrogenous manures.
5. Offals from the industries.
6. Phosphates.
7. Gypsum, chalk, marl, mud from ponds and rivers.
8. Manure salts—
   (*a*) Potassic salts.
   (*b*) Other salts.
9. Other fertilisers in the market; control of fertilisers.

V. Field experiments—

A. On the effect of different fertilisers.
B. Raising and manuring Coniferæ; Gramineæ; Cannabineæ; Dipsacaceæ; Chenopodiaceæ; Solanaceæ; Umbelliferæ; Papaveraceæ; Cruciferæ; Linaceæ; Papilionaceæ.
C. Utilising manure.

VI. Parts and secretions of the animal body—

1. Albuminates.
2. Blood.
3. Flesh, &c.
4. Fats.
5. Wool.
6. Bones.
7. Horns, &c.
8. Milk.
9. Saliva.
10. Urine and excrements.

VII. Animal food and digestion—

A. Components of the feeding-stuffs—
   (*a*.) Cereals.
   (*b*.) Vegetables.
   (*c*.) Hay, grass, and fermented food.
   (*d*.) Roots and tubers.
   (*e*.) Offal from industries.
   (*f*.) Residues from the fabrication of extract of meat.
   (*g*.) Diverse food; control of the feeding-stuffs.
B. Digestion and digestibility of food—General questions; Hay, straw, &c.; green fodder *v.* dry; fermented hay, steamed fodder; offals of the industries.
C. Preparation and conservation of the feeding-stuffs.
D. The different degrees of utilization of the food—animal food; inorganic food.

VIII. Animal production in its relation to food and external circumstances—

A. Increase and expenditure of constituents—
   (*a*.) In general.
   (*b*.) Respiration.
   (*c*.) Expenditure of nitrogen.
   (*d*.) Formation of fat.
B. Nourishment, diet, producing manure.
C. Rearing and keeping of animals—
   (*a*.) Cattle.
   (*b*.) Sheep—difference of breed, conversion of food.
   (*c*.) Pigs.
   (*d*.) Horses.
   (*e*.) Goats.
   (*f*.) Rabbits.
   (*g*.) Silkworms.
D. Diseases of domesticated animals.

IX. Conception and breeding.

X. Technology—

Forestry; wine; distillery; beet-sugar; milk; cheese and butter; diverse.

XI. Analysis.

It may be seen from this list that not a single important question on agricultural chemistry has been left untouched by our stations, and that a tremendous quantity of work has been done. I will not deny that there is now a certain stagnation in the pursuit of researches in agricultural chemistry, but it is partly occasioned by most of the work being done as far as possible in the present state of organic chemistry, as I have already mentioned; and, on the other hand, the stations are employed more and more with analyses for the protection of the practical farmer, except those organised for a special purpose—for instance, dairy, brewery, distillery and other stations.

In how far the German system of agricultural experiments might be adapted to England I will leave to others to decide, but I think the English farmers will agree with me when I say that there might be done more than there is at present. A dozen stations distributed over the kingdom could effectively check the adulteration of fertilisers, feeding-stuffs, and seeds, and would, I think, be more efficient than the present system. What concerns purely experimental stations, according to my views, they ought to be few, but supplied with a sufficient apparatus for doing work on a large scale. Let one of them make acclimatization, another feeding experiments, a third experiments for the benefit of dairying, a fourth for brewing, and so on, then they will really do some good; only field experiments on crops and manures must be conducted at different places at the same time, if they are to have any other besides an only local value. I am sure if Germany can afford to spend £30,000 annually on its experimental stations, England might do something in the same line, and it is to be hoped that the good example given by the Highland and Agricultural Society of Scotland will be largely and liberally followed.

Statistics for 1876 *of the Industrial Institutions of the United States, which have received the National Endowment of Land-scrip under the Act of July* 2, 1862.

Location of the Institution.	Name of the Institution.	Number of Professors and Assistants in the Agricultural and Mechanical College for the collegiate year.	Number of Students in the Agricultural and Mechanical College for the collegiate year.	Annual Interest derived from the Scrip or Land granted by Congress—July 2, 1862.	Number of Acres contained in the Agricultural and Mechanical College Farm.	Value of the Agricultural and Mechanical College Farm.
				$		$
Auburn, Ala. ...	Agricultural and Mechanical College of Alabama.	7	104	16,224	100	2,000
Fayetteville, Ark. ...	Arkansas Industrial University ...	12	45	10,400	160	12,000
Berkeley, Cal ...	University of California, Colleges of Agriculture and Mechanics.	19	50	45,000	200	200,000
New Haven Conn. ...	Yale College, Sheffield Scientific School	31	230	8,100	No farm.	...
Newark, Del. ...	Delaware College	8	43	4,980	...	...
Eau Gallie, Fla. ...	Florida State Agricultural College ...	... *	...	6,068	...	...
Athens, Ga. ...	University of Georgia. { Georgia State College of Agriculture and the Mechanic Arts.	8	93	14,010	60	1,500†
Dahlonega, Ga. ...	University of Georgia. { North Georgia Agricultural College.	5	245	3,000	25	1,000
Urbana, Ill.	Illinois Industrial University ...	15	187	28,200	570	56,000
La Fayette, Ind. ...	Purdue University, Indiana Agricultural College.	8	1	20,314	159	47,700
Ames, Iowa	Iowa State Agricultural College ...	15	300	34,822	850	51,000
Manhattan, Kans. ...	Kansas State Agricultural College ...	16	303	20,491	255	25,000
Lesington, Ky. ...	Kentucky University, Agricultural and Mechanical College.	8	94	9,900	433	130,000
New Orleans, La. ...	Louisiana State Agricultural and Mechanical College.	6	209	13,734	600	40,000
Orono, Me.	Maine State College of Agriculture and the Mechanic Arts.	8	115	7,864	370	10,000
College Station, Md....	Maryland Agricultural College ...	6	77	6,900	285	14,200
Boston, Mass. ...	Massachusetts Institute of Technology.	36	293	4,011	...	...
Amherst, Mass. ...	Massachusetts Agricultural College ...	8	111	8,022	383	37,000
Lansing, Mich. ...	Michigan State Agricultural College...	13	166	16,880	676	47,320
Minneapolis, Minn.	University of Minnesota. { College of Agriculture. College of Mechanic Arts.	8	6	13,901	120	12,000
Oxford, Miss. ..	University of Mississippi, College of Agriculture and the Mechanic Arts.	6	15	5,679	100	2,000
Rodney, Miss. ...	Alcorn University, Agricultural and Mechanical College.	4	...	5,679	250	5,000
Columbia, Ms. ...	University of Missouri. { Agriculture and Mechanical College.	8	21	2,018	640	60,000
Rolla, Ms. ...	University of Missouri. { Missouri School of Mines and Metallurgy.	6	70	1,022	...	...
Lincoln, Nebr. ...	University of Nebraska, College of Agriculture.	5	13	None.	320	18,422
Hanover, N. H. ...	Dartmouth College, New Hampshire College of Agriculture and the Mechanic Arts.	11	24	4,800	365	21,000
New Brunswick, N. J.	Rutgers College, Scientific School ...	10	42	6,960	100	45,000
Ithaca, N. Y. ...	Cornell University. { College of Agriculture.	32	26	35,000	150	22,000
	Cornell University. { Sibley College of the Mechanic Arts.	21	58			
Chapel Hill, N. C. ...	University of North Carolina, College of Agriculture and the Mechanic Arts	9	61	7,500	Unknown.	...
Columbus, Ohio ...	Ohio Agricultural and Mechanical College.	11	140	30,000	320	200,000
Corvallis, Oreg ...	Corvalis College, State Agricultural College.	4	51	Unknown.	35	5,000
Centre Country, Pa ...	Pennsylvania State College	13	161	24,420	600	75,000
Providence, R. I. ...	Brown University, Agricultural and Mechanical Department.	13	35	6,624	No farm.	...
Orangeburgh, S. C. ...	Claflin University, South Carolina Agricultural College and Mechanics' Institute.	6	40	10,000	116	10,000
Knoxville, Tenn. ...	East Tennessee University, Tennessee Agricultural College.	12	58	23,760	260	24,000
Bryan, Tex.	Agricultural and Mechanical College of Texas.	6	50	12,000	2,200	20,000
Burlinton, Vt. ...	University of Vermont and State Agricultural College.	8	23	8,130	No farm.	...
Blacksburgh, Va. ...	Virginia Agricultural and Mechanical College.	10	255	20,639	250	28,000
Hampton, Va. ...	Hampton Normal and Agricultural Institute.	20	256	10,319	190	33,000
Morgantown, W. Va.	West Virginia University, Agricultural Department.	5	2	5,400	No farm.	...
Madison, Wis. ...	University of Wisconsin, College of Arts.	16	124	13,490	196	40,000
	Total ...	473	4,197	526,283	11,338	1,295,192

* This college has not been opened to students.

† Exclusive of the value of the college building, the original cost of which was $ 24,000.

JUTE IN THE UNITED STATES.*

It is a costly improvidence to pay other nations for staples and products which we can raise and manufacture as cheaply as they can. For all imported jute fabrics we are now paying the cost of production in India, the freight to England, the expense of manufacture, the transportation to the United States, and the commissions of all the factors and insurance-agents through whose hands the goods have passed. Millions of dollars are now annually paid to foreigners for labors that ought to be performed by Americans. We are heedless of the lessons of public economy. A diversity of employments and an industrial independence of other countries will most efficiently promote the welfare of our own people. It is the true policy of the United States to introduce and naturalize the industries of the Old World and to foster the commonwealth of the nation by paying to American handicraft the millions which are now the rich reward of European skill. The English Government finds it very difficult to introduce improved machinery or scientific methods into the agriculture of India. The inert masses resist innovation with a conservatism born of centuries of stagnation. The traditional implements and processes of an earlier age are still used in the tillage of India. The ploughs and harrows and the machines for spinning and weaving are of the rudest description. The natives are too poor to buy improved tools and too ignorant to use the better methods. They have not analized their soils, ascertained the best succession of crops, tested the different systems of fertilization or improved their primitive processes of preparing and manufacturing their staples. In fine, their labor is unintelligent, and therefore ineffective and unthrifty.

An industrial comparison of Southern States with India greatly encourages our hopes of success in this new industry. The labor of the South is far more intelligent than that of India, and it is constantly under skilful guidance. The Southern planters will not follow an antediluvian style of agriculture. In India the best soil is usually devoted to raising jute for the market and the poorer land is left for the production of jute-seed. The natural consequence of this course is the deterioration of the seed. In the United States, on the contrary, a portion of the best land has been reserved for seed, and the result is a signal improvement in the quality of the seed. American jute-seed is one-sixth heavier than that of India. The broadcast sowing of Bengal is uneven and wasteful. Our patent drills, saving 10 or 15 pounds of seed to the acre, do the work with far greater rapidity and equality of distribution. The efficiency of our agricultural machinery will more than neutralize the seeming advantage which India possesses in the cheapness of its manual labor. It would take tens or hundreds of Indian hands to do the work of one American machine.

It will be strange, indeed, if the mechanical ingenuity which in some departments of manufacture has triumphed over the cheap skilled labor of Europe, and enabled the United States profitably to export to the great centres of industrial art watches, cutlery, agricultural implements, coarse domestics, and some finer fabrics, cannot win a far greater victory over the unskilled hand labor of India.

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* From the United States Agricultural Department Report.

POISONOUS GRAIN FROM GUZERAT.

On examination of the grain you sent me (known in Bengal as Kodoo and in this country as Varagu) I have not been able to discover anything in it to account for its poisonous effects.

A number of instances are recorded of the bad effects of this grain on man and cattle. It is understood that the grain raised at the proper season is wholesome, that that raised on the same ground as a second crop and that raised on wet marshy ground are both unwholesome.

Dr. Bonavia of Bengal is of opinion that the age of Kodoo has little to do with its poisonous qualities. He thinks that, after rain falls and the ear is ripening, a fungus attacks it, and it is this which is to blame. Washing the grain well before being cooked renders it harmless.

Dr. Macrae when acting Chemical Examiner at Madras, examined microscopically specimens of Varagu believed to be bad as well as good Varagu and reported that the one could not be distinguished from the other. On another occasion he made the following statement in regard to a sample of bad grain submitted to him for examination:—

"Placed in an air-tight glass chamber exposed to the influence of air and water some of the seeds germinated in three days, while a plentiful crop of what (microscopically) appeared to be ordinary mould was developed."

The poisonous grain is not a product of a variety but of the plant that yields the healthy grain.

Bad seed may produce wholesome grain.

(Signed) R. WILKINS, F.R.C.S.,
Lecturer on Botany in the
Madras School of Agriculture.

APPENDICES.

APPENDIX

TO THE

SAIDAPET EXPERIMENTAL FARM REPORT.

STATEMENT OF THE ACCOUNTS OF THE SAIDAPET EXPERIMENTAL FARM, 1878-79.

—	Receipts.			Expenditure.		
	RS.	A.	P.	RS.	A.	P.
Fruits, vegetables, and fodder ...	939	9	1	...		
Grains and seeds	217	9	10	733	7	7
Cotton and indigo	385	6	2	...		
Live-stock, &c.	264	6	0	3,083	15	7
Rents, sundries, &c.	732	7	1	385	15	4
Manures	...			678	14	8
Implements and machines	...			1,345	2	8
Cooly labor	...			4,182	11	7
Establishment	...			1,585	10	4
Despatching seeds	...			185	14	7
Total ...	2,539	6	2	12,181	12	4

VALUATION OF THE SAIDAPET FARM AND ESTATE ON THE 31ST MARCH 1879, COMPARED WITH THAT MADE ON THE 31ST MARCH 1878.

—	Value of Stock on the 31st March 1878.			Increase in the Year.			Decrease in the Year.			Valuation of Stock on the 31st March 1879.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
ESTATE—												
Land	37,480	0	0	320	0	0	...			37,800	0	0
Buildings*	21,750	0	0	150	0	0	...			21,900	0	0
Wells and channels	7,000	0	0	...			...			7,000	0	0
Total ...	66,230	0	0	470	0	0	...			66,700	0	0
FARM—												
Live-stock.												
Cattle	2,650	0	0	...			990	0	0	1,660	0	0
Sheep	1,285	0	0	...			105	0	0	1,180	0	0
Pigs	...			140	0	0	...			140	0	0
Poultry	90	0	0	45	0	0	...			135	0	0
Dead-stock.												
Grains, &c.	614	0	0	422	0	0	...			1,036	0	0
Manures	310	0	0	...			85	0	0	225	0	0
Implements	6,426	0	0	...			188	0	0	6,238	0	0
Growing crops	920	0	0	...			140	0	0	780	0	0
Fruit and fuel trees	5,565	0	0	3,435	0	0	...			9,000	0	0
Total ...	17,860	0	0	4,042	0	0	1,508	0	0	20,394	0	0
Grand Total ...	84,090	0	0	4,512	0	0	1,508	0	0	87,094	0	0

* Does not include any buildings, but those belonging strictly to the Farm.

APPENDIX

TO

THE GENERAL REPORT.

STATEMENT OF THE ACCOUNTS OF THE MADRAS AGRICULTURAL DEPARTMENT.

	RS.	A.	P.	RS.	A.	P.
Expenditure.						
I. General Supervision—						
Establishment ...	19,382	10	6			
Travelling allowance ...	630	11	6			
Contingencies ...	579	4	3			
Ploughing match ...	189	14	0	20,782	8	3
II. Saidapet Experimental Farm as detailed in the Appendix ...	...			12,181	12	4
III. Implement Workshops as per statement given in para. 117. of the Report ...	...			1,730	0	4
IV. Educational (School of Agriculture) as per statement given in para. 44 of the Report ...	...			16,170	0	7
V. Estate Improvements—						
Repairs and alterations to buildings ...	1,166	10	10			
Trees and planting ...	245	12	4			
Manufacture of drain pipes and subsoil drainage ...	241	5	0			
Brick and morter bridges under main roads ...	97	1	2			
Contingencies ...	139	8	3			
Fence around Roshumbaug Village ...	151	0	8			
Reroofing western sheep house and building a tool house ...	301	8	9			
Extension to water channels ...	601	12	7			
Remaking a portion of new road from the Tamarind Tope, north, and the Mount Road ...	369	4	0			
Sundry work and alterations ...	384	9	0			
Reroofing old cattle shed and converting it into a sheep shed ...	361	2	3			
2 wells ...	201	10	10	4,261	5	8
VI. Other charges not paid through the department—						
Allowance to Surgeon paid by the Saidapet Treasury Deputy Collector ...	...			848	11	4
Expenditure incurred by the Public Works Department—						
Constructing Laboratory for the School of Agriculture ...	5,449	4	0			
Providing a temporary building for the accommodation of School of Agriculture ...	1,550	0	0			
Clearing the Chembrumbaukum Channel to the Farm ...	482	2	0	7,481	6	0
Paid value of books by transfer ...	48	0	0			
Paid value of books supplied by the Director of Public Instruction by transfer ...	166	11	8	214	11	8
Paid Public Works Workshops for 1 casting bell by transfer	86	0	0			
Paid Public Works Workshops for 2 seals by transfer ...	5	8	0	91	8	0
				63,762	0	2
Income.						
Adjusted balance at the beginning of the year ...	1,91,215	13	7			
Provincial Grant ...	20,000	0	0			
Receipts from the Surplus Pound Fund during the year 1878-79— ...	61,825	1	9			
Saidapet Experimental Farm as per statement given in the Appendix ...	2,539	6	2			
Implement Workshop ...	1,720	14	7	2,77,301	4	1
Balance in favor of the Department on the 1st of April 1879 ...	...			* 2,13,539	3	11

(Signed) C. BENSON, M.R.A.C.,
Acting Supt. of Govt. Farms, Madras.

SAIDAPET,
29*th May* 1879.

* This is approximate only; see note, page 136.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ THE FOLLOWING PAPERS :—

Proceedings of the Board of Revenue, dated 28th July 1879, No. 2,131.

Read the following letter from C. BENSON, Esq., M.R.A.C., *Acting Superintende Government Farms, to C. A. GALTON, Esq., Acting Secretary to the Boa of Revenue, dated Saidapet, 16th July* 1879, *No.* 812 :—

I HAVE the honor to forward herewith two copies of the Saidapet Farm Repo for the official year 1878-79. The complete report will, I hope, be submitted e long, but the matter altogether rests with the printer.

IN his letter, No. 812, dated 16th instant, the Acting Superintendent of (ernment Farms submits his Assistant's report on the Saidapet Experimental F for 1878-79, which will be forwarded for the information of Government. I noted that Mr. Benson hopes that the complete report will be submitted ere lo

2. The year was not favorable for the farm, the total rainfall registered b only 33 inches—about 18 inches less than the average of the previous ten ye The rain, too, was badly distributed, more than half of it falling unseasona the consequence was that the growth of plants was checked in October when rust set in and destroyed one crop of cholum entirely.

From various experiments made it was found that sowing cholum in line at distances 9 inches apart produced better crops than any other description of sowing.

3. The Madagascar paddy was a failure in point of yield, and is costly to raise as it takes long to mature.

4. Some experiments were made with tobacco. Lunka and Madura tobacco grew well, as did also an Italian variety, but the most successful was the Maryland tobacco, which yielded the largest return and finest leaf. The attempt at curing, however, seems to have been a partial failure, and the Acting Superintendent should report on the quality of the tobacco thus dried.

5. Altogether crops were raised on 214 acres, but some of these were grazed down by cattle, and it has not been possible to record the outturn. Some experiments were made in deep ploughing and in the treatment of sugar-cane and cotton with various kinds of manure. The cattle in the yard did well and were maintained at a cost about 40 per cent. higher than in the previous year.

6. The Swedish plough for heavy work and the American plough for light ploughing were in use during the year; two Collins' ploughs sent to the farm for trial did not work satisfactorily, but they are capable of some improvement.

7. A chaff-cutter made on the farm at a cost of Rupees 36 is capable of cu up 790 lbs. of fodder at a cost of 6 annas per diem.

8. The double mhote lift is said to continue to give the most favorable resu and may possibly be still further improved by the substitution of leather for t ordinary ropes now in use.

9. A small piece of land on the river bank was added to the estate, and a large ıber of casuarinas were put out with castor plants between; the season was vever unfavorable and the castor plants were destroyed by drought before they ɔrded shade.

(A true Copy and Extract.)

(Signed) J. STURROCK,
Acting Sub-Secretary.

Proceedings of the Board of Revenue, dated 28th August 1879, No. 2,475.

ead the following letter from C. BENSON, Esq., M.R.A.C., *Acting Superintendent of Government Farms, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Saidapet, 2nd August* 1879, *No.* 959 :—

I HAVE the honor to submit herewith the annual report of this department for year 1878-79. The report on the School of Agriculture was forwarded to vernment on the 25th of June 1879, through the Director of Public Instruction, in previous years; and my report on my tour in Trichinopoly has already been ɔmitted to the Board.

2. The instructions regarding the omission of all papers of general interest m the report were not received until the selections for this year were in the Press, large number of interesting extracts from our correspondence which I had have been omitted.

THE publication of this bulky volume was quite unnecessary, almost all the er having already appeared elsewhere. Under G.O., dated 16th June 1879, 1,286, and G.O., dated 23rd June 1879, No. 1,325, the Saidapet Farm report, Agricultural School report, and reports on miscellaneous agricultural operations ucted by the Superintendent, are each to be separately submitted as occasion ands. The tour reports also are necessarily submitted separately. The matter, any, which remains for a report on "Government Farms" generally need not ccupy more than a page or two. The present volume having been printed will now be submitted to Government.

2. The Board take the opportunity to remark that the reports issued by the Superintendent might in all cases be condensed with advantage. The same amount of information could be given in a much briefer space. The Board are aware that the growth of the reports has been gradual and that there is nothing special in the size of the reports this year. But the matter demands the Superintendent's attention.

3. Referring to G.O., dated 16th June 1879, No. 1,286, the Superintendent should submit to the Board copy of his report on the Agricultural School, at the same time that he forwards the original to the Director.

(A true Copy and Extract.)

(Signed) C. D. MACLEAN,
Acting Sub-Secretary.

ORDER THEREON, 9th October 1879, No. 2,035.

WITH the earlier of the foregoing Proceedings the Board of Revenue forward Acting Superintendent's report on the operations on the Saidapet Farm in 8-79. This report was sent to the Board on the 16th July, but in an incomplete te as the financial, &c., statements were not appended but were attached to the ume submitted with the Board's later Proceedings. This volume contains the

report on the School of Agriculture and on Mr. Benson's tour in Trichinopoly; and as the former has already been disposed of by Government and the latter is still under consideration, neither should be distributed with the Farm report, which has its distinct use and distribution list, and should, as already ordered, be separately submitted.

2. The success of the operations on the Farm was affected by a somewhat abnormal season. The crops suffered from fungoid diseases and rats, and it is suggested that the increase in the numbers of the latter may be due to the too great destruction of snakes.

The outturn of the crops generally was not good, but experience was gained respecting the value of, and drawbacks to, deep ploughing.

3. The Government notice that in the full and interesting account of the experiments made in growing and curing different kinds of tobacco, nothing is said of their market-value. This should be at once ascertained and samples analysed. Further experience is also required to test the belief (paragraphs 79 and 83) that "when tobacco is grown during the cold season irrigation may be entirely dispensed with."

4. Paragraphs 22—27 review the results of the subsoil drainage experiments of 1875. Owing to the nature and lay of the land the work was attended with difficulty and, from the inexperience of the workmen, indifferently executed; a striking improvement was, however, found in the physical condition of the soil. The drains have now been relaid with greater care and success at a cost of about Rupees 20 an acre, and it only remains to compare the future yield of the land and thus put the value of the operation to a practical test.

5. *Financial Results.*—In the absence of all details as to the manner in which the estimate is arrived at, no opinion of the accuracy of the value of the estate and dead stock, which is estimated to have materially increased during the year, can be formed. This information should be at once supplied. The Government presume that the prescribed forms of accounts are now in use and that a more instructive financial statement will accompany the next report.

6. A serious falling off is again reported* in the value of the Farm cattle, and explanation must be afforded. The illness and death of the Australian cows is shown by Mr. Western to have been in all probability due to preventible causes, and his remarks must be borne in mind in the treatment of any foreign cattle that may hereafter be bought.

	Value.	Decrease.
	RS.	RS.
*1877-78	3,980	1,330
1878-79	2,650	990

(True Extract.)

(Signed) J. H. GARSTIN,
Acting Secretary to Government.